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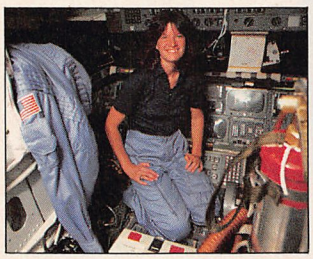

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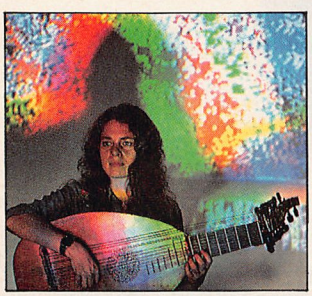

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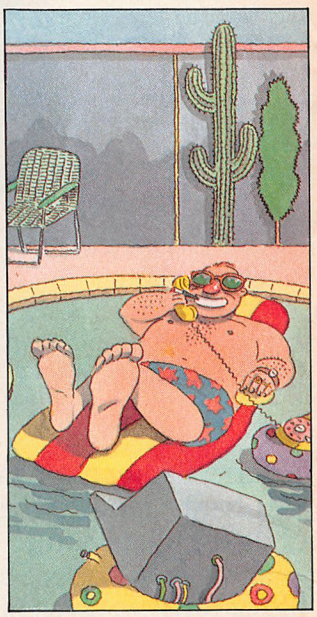

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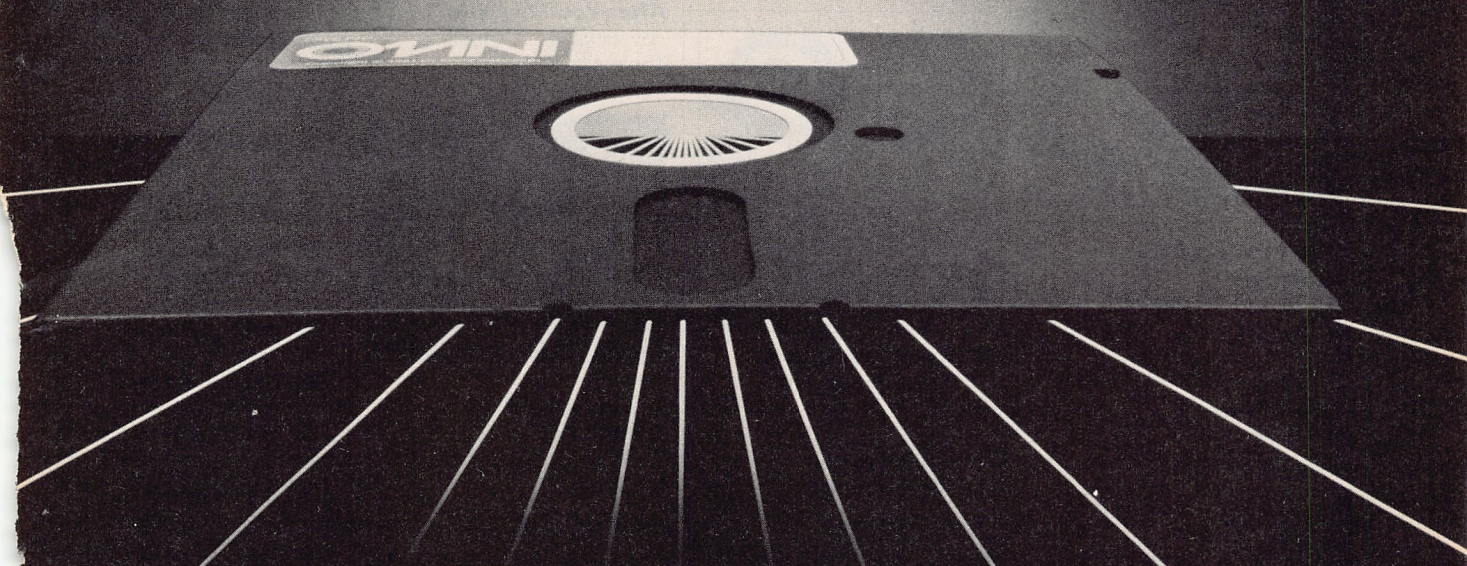

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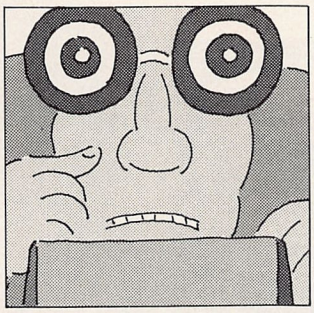

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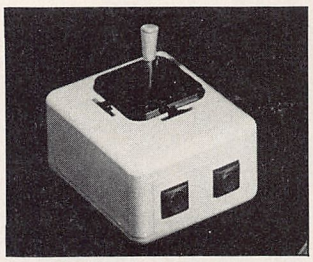

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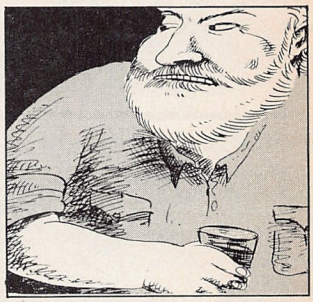

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Statistical Analysis and Reader Feedback

An interesting and revealing trend is developing at *Popular Computing*. As one of our editors said recently, "More and more of our readers are starting to write for the magazine." Each month the pile of unsolicited manuscripts increases in both quantity and quality. As you, our readers, become more familiar with your computers and their many applications you become eager to share your discoveries, joys, and frustrations with others.

Many of your submissions are variations on similar themes. Almost every professional writer, it seems, who has made the quantum leap from electric typewriter to word processor feels compelled to document that experience. Widows or widowers who have lost their mate to the all-consuming home computer is by now a familiar theme and one written about with varying degrees of humor. And because we are a nontechnical publication edited primarily for first-time computer users, many readers have submitted manuscripts giving helpful advice on buying your first system, frankly outlining the mistakes they made when they made their initial purchases.

Readers often send in articles that improve, expand, or modify a program we've already published. Other submissions are reviews of application programs that some readers have found indispensable in their daily work.

Sometimes the mail brings an unexpected jewel. We received a game program from an 11-year-old boy and a comical lament from a 76-year-old retired executive who complained about all the confusing letters and numbers that computer companies are attaching to their product names these days. Many of the submissions are highly opinionated pieces that lash out at poorly written manuals or promised but nonexistent after-sale support.

For a variety of reasons, of course, we cannot publish each manuscript we receive. Some submissions are too specialized, some too general, some take an advocacy approach that our editors feel isn't supported by the facts. But each submission is studied with care. It is your way of telling us who you are and what direction you would like to see *Popular Computing* take. Some of our best articles and ideas come from our readers.

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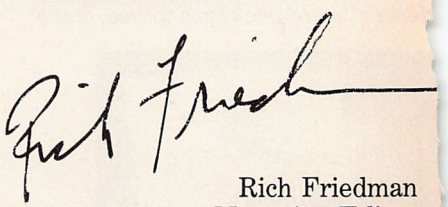

Rich Friedman
Managing Editor

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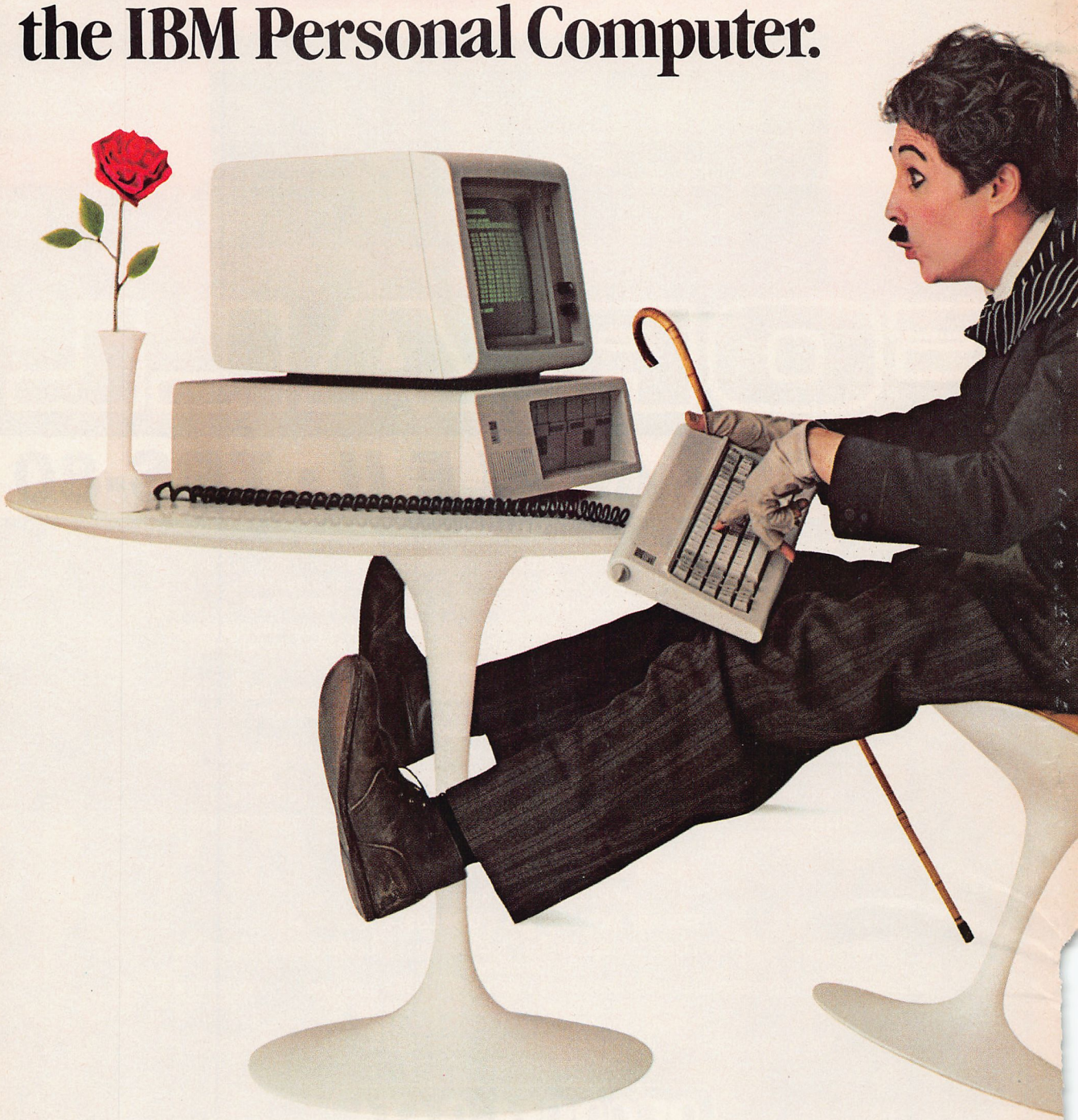
How to test drive the IBM Personal Computer.



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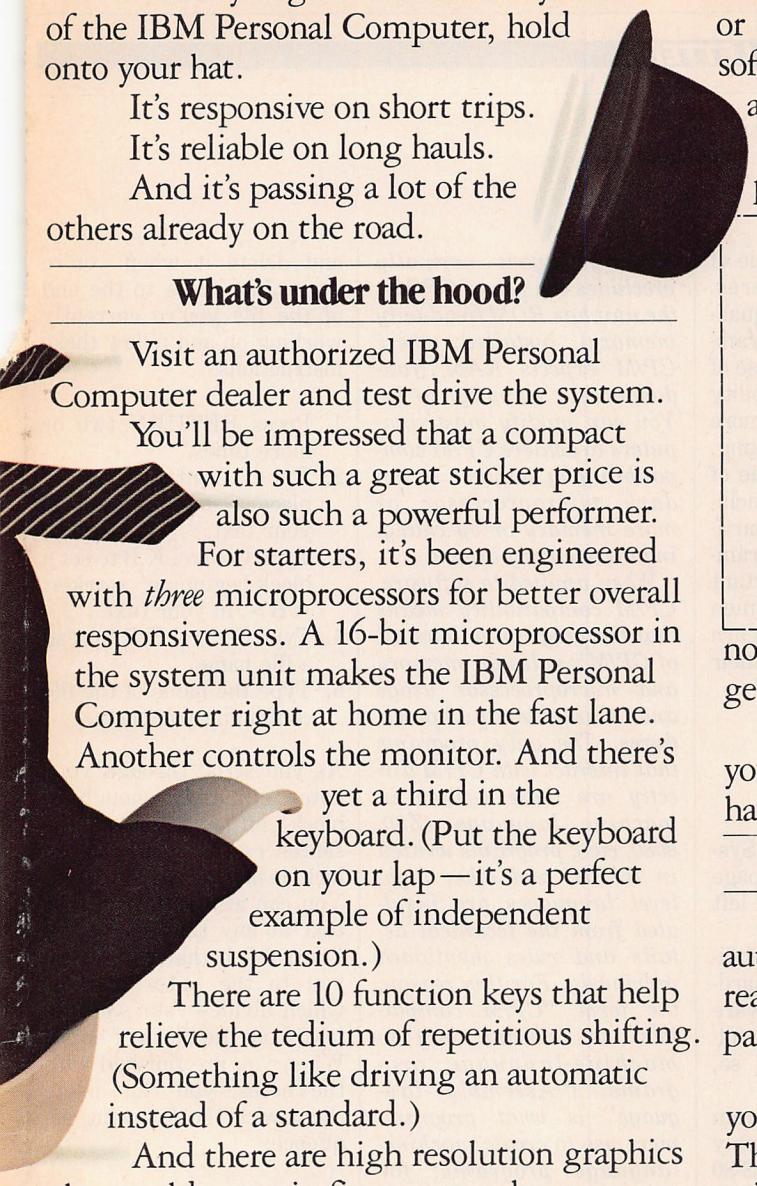

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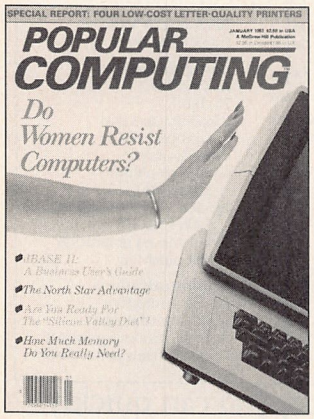

Bilateral Thinking

Dear Editor:

In her otherwise sound article ("Do Women Resist Computers?" January 1983, page 66), Ellen Jaffe McClain misinterprets women's "early superiority for language skills" by claiming that women tend to predominantly use the left hemisphere of the brain. Two decades of research indicates that men tend to be more left-hemisphere dominant than women. Women, on the other hand, tend to use either the right (visual, gestaltist) hemisphere or both hemispheres. This bilateral thinking ability enables women to process language in both the left and right hemispheres, resulting in superior language skills.

Cerebral-hemisphere research is a relatively recent endeavor, and much is still to be learned about the special capabilities of the hemispheres. A number of researchers conclude that we are also capable of a dialectical mode of thought, which can occur when both hemispheres interact to work on a problem. This mode is thought to be the one most closely related to creative thinking. It may be that the dialectical mode is more likely to occur in people who are most capable of using both hemispheres. Women may be well qualified for computer programming not so much because of their left-hemisphere ability but because they are more capable of bilateral thinking.

Regardless of the issue of cognitive modes, the conclusion that women are particularly adept at programming leads to an important question: why do women computer programmers earn only 75 percent of what their male counterparts earn?

Mariana King
Los Angeles, CA

CP/M Compatibility

Dear Editor:

"The CP/M Operating System" (February 1983, page 102) was excellent. But it left me with two questions.

First, is CP/M compatibility strictly a function of hardware, or must any software running under CP/M also fulfill certain criteria? If so, what are the criteria?

Second, will a program written in Z80 assembly language run on a TRS-80 Model III that's been equipped with CP/M hardware, or does CP/M compatibility preclude the use of assembly language?

J. Michael Meuer
Minneapolis, MN

The term "CP/M compatibility" means different things when applied to hardware and software. In the case of hardware, it means that a computer has an 8080-compatible microprocessor and ample memory to run the CP/M software. It also means there are restrictions on how the memory is arranged in the computer. The TRS-80 Model III, for example, has a compatible microprocessor and ample memory, but its internal memory layout normally precludes the use of CP/M—the unit has ROM (read-only memory) installed where CP/M expects RAM (random-access memory) to be. You can modify most computers to achieve CP/M compatibility by adding a secondary microprocessor or more memory or by changing the memory layout.

When applied to software, CP/M compatibility means that the program follows all of CP/M's rules for memory and microprocessor usage and I/O (input/output) procedures. The only programs that interact with CP/M directly are those written in machine language (Z80, 8080, etc.); programs written in BASIC and other high-level languages are insulated from the technical details and rules mentioned previously. For this reason, the term "CP/M compatible" is relevant only to machine-language programs. ("Assembly language" is what programmers use to create machine-language programs; for most purposes, the two terms can be used interchangeably.)

To answer your second question more directly: a Z80 program will run on a modified TRS-80 if it follows CP/M conventions.

Browsing with Wordstar

Dear Editor:

I enjoyed Steven Levy's article on Wordstar ("How I Learned to Use Wordstar," February 1983, page 116).

Levy complained about Wordstar's lack of a browse feature. Actually, you can use block-move techniques to get text from another file and insert it temporarily into the file you're working on. You can then browse through the added material and delete it when you're done. Just move to the end of the file you're currently working on and follow these instructions.

1. Press RETURN two or more times.
2. Type Control-K,1, to place a <1> marker in your text.
3. Type Control-K,B to set a block-beginning marker, <B>, in your text.
4. Type Control-K,R to read a file name.
5. Type the name of the file containing your notes.

As you scroll through your notes, it's easy enough to block off and move any sentences that you want to include in your working text. You can also return to that text at any time by typing Control-Q,1; that will return you to the <1> marker, which divides your working text from the block of notes. When you are finished with the notes, you can delete them with the following sequence:

1. Type Control-Q,C to move to the end of the file of notes.
2. Type Control-K,K to set a block end marker, <K>.
3. Type Control-K,Y to delete the entire marked block of text.

Some monitors have the ability to display text in either bright or dimmed

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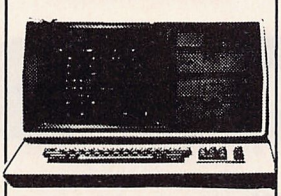

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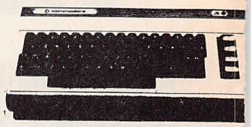

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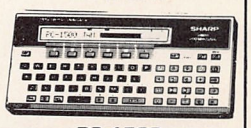

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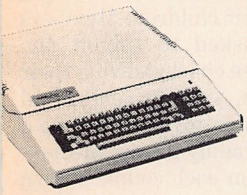

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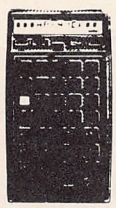

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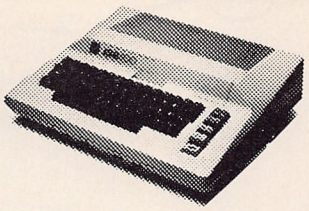

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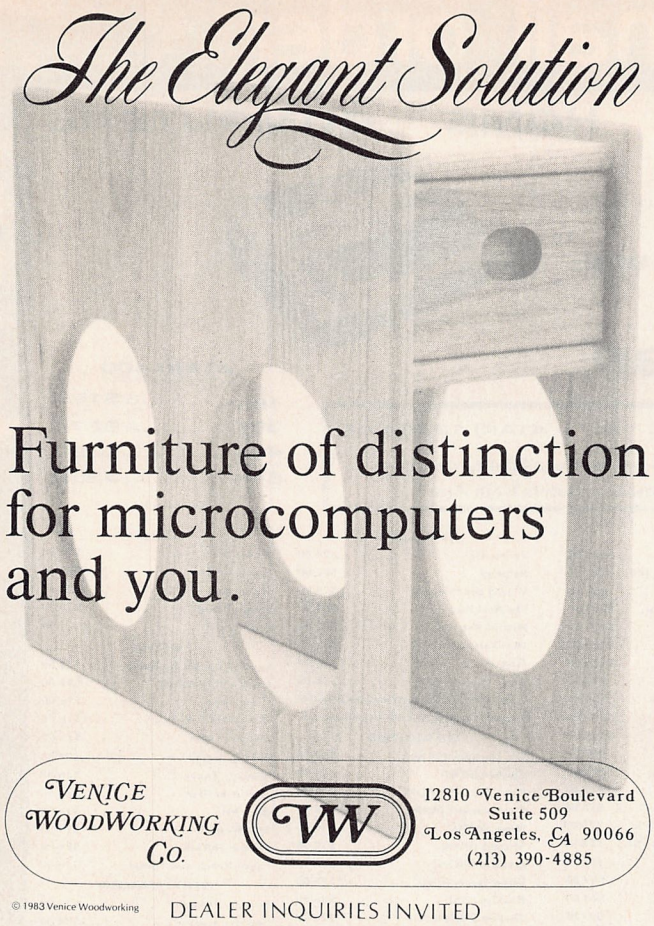

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form. This is normally used to display help menus less brightly than your working text. It can also be used to visually distinguish a block of notes from your working text. If you want to print the notes in dimmed letters, use the following sequence instead of the first one given above.

1. Press RETURN two or more times.
2. Type Control-K,1 to set a <1> marker.
3. Type Control-K,B to set a block-beginning marker, <B>.
4. Press RETURN two or more times to insert some blank lines.
5. Press Control-K,K to set a block-end marker, <K>.
6. Move the cursor up one space so that it is within the marked block.
7. Type Control-K,R to read your file of notes.
8. Type the name of the file of notes.

The notes will now appear in dimmed letters.
Henry Hoskey
Universal City, CA

Past Imperfect

Dear Editor:

A friend who knows of my interest in genealogy gave me the December 1982 issue of *Popular Computing* so that I could read "The Human Roll Call" (page 48). Although the story is generally excellent, it has two major errors. First, the proper name of the Mormon Church is the Church of Jesus Christ of Latter-Day Saints, not the Church of Latter-Day Saints, as Rachael Wrege called it in her article.

The second error is in your explanation of the four-generation sheets that members were asked to submit. "Family-group sheets" are not "pedigree charts." Pedigree charts show one person and his or her ancestors, while family-group sheets show a couple and their children. Members were asked to submit one pedigree chart showing their parents, grandparents, and great-grandparents, and seven family-group sheets—one from each couple shown on the pedigree chart.

Thank you for a most informative article.
Louise L. Golden
Seattle, WA

"Gigabytes" Reconsidered

Dear Editor:

With the advent of videodisc recorders for computers, it's apparent that memory systems soon will be measured in billions of bytes of information storage.

With an eye toward more levity and less brevity than that adopted by the electronics engineers of IEEE when they went from megacycles to gigahertz, I recommend that we computophiles henceforth describe our new billion-byte computer files in *bigabytes*.
Arvid Rosenboom
Stateline, NV

A Question of Degree

Dear Editor:

The article "Book Publishers Warm to Computers" (January 1983, page 100) was circulated here at Harper & Row. Although I enjoyed reading the article, I think some statements need to be modified.

My information about book publishers, especially textbook publishers, shows very limited activity in both on-premises typesetting and acceptance of authors' electronic manuscripts. Neither seems to save money or time, certainly not to the degree celebrated by the authors of the article.
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How do you transfer a program from one CP/M machine to another when the disk formats are not compatible? Thomas Boff, Dayton, OH

First you must establish a communications link between the two computers.

You can connect computers within 50 feet of each other by running three-wire cable between their RS-232C ports. (A knowledgeable friend or a computer dealer may be able to help you set up the cable.) Using this approach, communications can be very fast—up to 19,200 bits per second (bps).

For remote connections, you'll want to connect each computer to a modem so that the systems can communicate over the telephone lines. Depending on the modems you use, your communications speed will probably be limited to 300 bps or 1200 bps.

Once the computers are physically linked, you'll need some communications software. Typically, both computers must be running an identical program in order for "handshaking" and error checking to take place. (Be sure the communications program you use has error checking. When you're sending or receiving programs, one missed bit can render the entire program useless.)

You're probably wondering how much a fancy communications program is going to cost. You may be pleasantly surprised to hear that one of the most widely used products for sending files is a public-domain program called Modem7. There are no license fees for using it. The only expense you might have is paying someone (that friend or helpful dealer, again) to install the program on your computer.

Many computer bulletin-board systems use Modem7 for downloading and uploading software from users. To find out how you can get the program for your computer, contact your local computer user group or any computer store that sells CP/M products.

A couple of other commercial products for sending and receiving programs are:

BSTAM (file transfer) and BSTMS (interactive communication) from Lifeboat Associates, 1651 Third Ave., New York, NY 10028 (212) 860-0300.

Crosstalk, from Microstuf, 1845 The Exchange, Atlanta, GA 30339 (404) 952-0267.

Once you have two computers linked with hardware and software, you can communicate interactively (both users can send and receive keyboard messages) and you can transfer programs stored in disk files from one computer to the other.

After the transmission, the transferred program should be ready to load and run. However, occasionally you must configure the program to match the keyboard and display characteristics of your computer or terminal. Instructions for this procedure are usually included in the program documentation.

I have a Sharp PC-1500 pocket computer that I'd like to be able to use with standard computer peripherals—especially modems. Can you help me find any? John H. Mason, Hickory, MA

Look no further than your local Sharp dealer or Radio Shack store. Radio Shack sells the PC-2, virtually the same machine as the Sharp PC-1500. Peripherals for one machine will generally work with the other, although the dealers won't guarantee that.

Sharp recently introduced the model CE-158 communications adapter, which includes an RS-232C interface as well as a parallel printer interface. The unit plugs into the pocket computer's 60-pin input/output (I/O) bus connector. With the CE-158 connected, your pocket computer can communicate over telephone lines via a modem. The unit also comes with communications software in ROM (read-only memory), so it can be used without custom programming. The list price for the Sharp CE-158 is $229.

By the time you read this, Radio Shack will also have introduced an RS-232C interface for its PC-2. The unit plugs into the PC-2's 60-pin I/O bus connector and can operate from built-in nickel cadmium batteries or from an AC adapter, which is included. The interface has 16K bytes of software in ROM, adding 32 commands to the pocket computer's built-in programming language. One of the commands activates a built-in, interactive terminal program. The Radio Shack unit (catalog number 26-3612) sells for $199.95.

Is there an Atari user group in the New York City area? Donald Woodford, Cambria Heights, NY

A quick call to Atari's User Group Support Program uncovered the name of one such group: SOAP (Atari User Group), 4 Park Ave., New York, NY 10016.

Atari maintains a list of over 200 user groups around the country. For a copy, write Atari Inc., User Group Support Program, POB 50047, San Jose, CA 95150.

Suppose I buy one of the low-cost printers for my Sinclair ZX81. Later on, if I get a more powerful computer, will I be able to use the same printer? Clarence Thomas, Prattville, AL

A printer that plugs directly into the Timex/Sinclair computer's I/O bus cannot be connected directly to other personal computers. The Sinclair I/O bus is not compatible with either the Centronics parallel or the RS-232C interface, the two standard ones.

However, it would not be difficult or expensive to convert the ZX81 bus to a Centronics bus, and you can expect companies to be offering converters in the future. On the other hand, as a solution a converter is far from ideal because every extra piece in a computer system adds to the potential for electrical noise that may interfere with data transmission or computer operation.

A better solution might be to purchase a standard Centronics or RS-232C interface for your Timex/Sinclair computer. That way you can use a standard printer with your computer. And when you change computers, your printer will probably work without the need for any adapters.

The following companies are among those that provide peripherals and adapters for the Sinclair and Timex computers:

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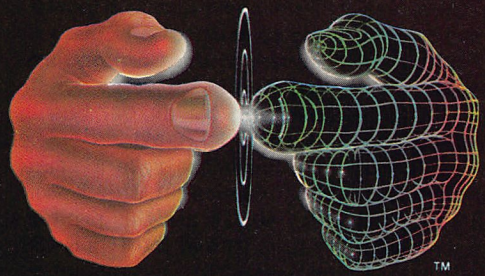

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CAI Instruments Inc., POB 2032, Midland, MI 48640

Cosmonic Products Inc., POB 10358, San Jose, CA 95157

Memotech Corporation, 7550 West Yale Ave., #200, Denver, CO 80227

How would I go about setting up a private online database? Lionel Norris, Brooklyn, NY

A private online database consists of a computer with plenty of mass storage (floppy or preferably hard disks), an auto-answer modem (i.e., one that's capable of answering incoming telephone calls), and software to converse with the computer that's calling in.

The simplest packages are known as electronic-message or bulletin-board systems. They enable callers to store and retrieve messages. The least expensive systems are limited to one caller at a time, but with a multiline modem and multiuser software several people can call in and use the system at once.

Electronic-message systems offer various levels of security as well as some limited database-management features. The most popular uses for these systems include remote order entry, inventory-status inquiries, and electronic-newsletter distribution.

The following is a selective list of addresses you can write to for more information about bulletin-board packages for your computer:

ABBS 4.0 for the Apple II. Microsoftware Systems, Suite 400, 7927 Jones Branch Dr., McLean, VA 22102.

Bullet-80 for the TRS-80 Models I and III, Computer Services of Danbury, POB 993, Danbury, CT 06810.

CBBS for CP/M microcomputers. CBBS, 5219 West Warwick, Chicago, IL 60641.

Conference Tree for the Apple II. Communitree Group, Suite 207-3002, 470 Castro St., San Francisco, CA 94114.

Connection-80 for the TRS-80 Model I. B.T. Enterprises, 171 Hawkins Rd., Centereach, NY 11720.

FORUM-80 for the TRS-80 Model I and Model III. FORUM-80 Headquarters, 7600 East 48th Terr., Kansas City, MO 64129.

Net-Works for the Apple II. Advanced Data Systems, 7468 Maple Ave., St. Louis, MO 63143.

Remote North Star Bulletin Board for North Star or CP/M with either Microsoft BASIC or Micro Mikes BAZIC. Microstuf, 1845 The Exchange, Atlanta, GA 30339 (404) 952-0267.

People's Message System (PMS) for the Apple II, Datel Systems Inc., POB 817, Lakeside, CA 92040.

ST80-X10 host program for the TRS-80 Model I/III. ST80-PBB personal bulletin-board system for the TRS-80 Model I/III. ST80-CC electronic-mail system for the TRS-80 Model I/III. MOUSE-NET bulletin-board system for the TRS-80 Model I/III. All available through Lance Micklus Inc., 217 South Union St., Burlington, VT 05401.

Two questions: Is it possible to connect an Epson printer to the Commodore 64? And is Visicalc available for the 64? Sue Gervais, Holt, MI

Commodore sells a modified version of the Epson MX-80. To use this printer, you must add the IEEE-488 interface to the computer. Alternatively, you can add a parallel interface to the Commodore 64, which will enable you to connect any Centronics parallel interface printer, including those by Epson, to your Commodore. Commodore doesn't offer the parallel interface, but you can get one (model MW-302, $119.95) from Micro World Electronix Inc., 6340 West Mississippi Ave., Lakewood, CO 80226.

Visicorp has no plans to offer a version of Visicalc for the 64. Commodore, however, sells a comparable series of programs: Easy Calc, Easy Plot, Easy Finance, and others.

My computer has a single-sided disk drive. One evening I became curious and decided to try to use the other side of a floppy disk. I punched another notch and another sector hole in the envelope at the appropriate places, and presto—my disk capacity was doubled. To gain access to the second side, I flip the disk over. Since I started flipping disks, I haven't noticed any increase in disk errors or disk failures. Why don't manufacturers advertise this capability? Mark M. Payne, Glendale, CA

Single-sided disks are certified only on one side. The other side either has never been tested or it has been tested and found defective. Either way, you use the second side at your own risk.

In a single-sided disk drive, a pressure pad rests against the unused side of the floppy disk. Often bits of debris become caught between the pad and the disk surface, producing concentric scratches. The scratches don't affect the use of the good side of the disk—unless, of course, you flip the disk. Then two things happen: you begin trying to use a possibly scratched disk surface, and your original (good) disk surface is now exposed to the potentially damaging pressure pad.

Damage to the disk envelope is another problem. By punching a notch in the envelope, you void the manufacturer's warranty on the disk media. Disk envelopes are made of polyvinyl chloride, a material that shatters. So even though your cut appears clean, cutting the envelope actually produces many tiny particles that can scratch the disk surface.

Sure, you can flip a floppy disk if you're careful. But don't put much confidence in the disk afterwards.

Timex/Sinclair BASIC does not include the statements READ and DATA, which are used for getting numeric or string information into a program. If I want to run a program that requires these statements, can I do without them? Jeff Adkisson, Austell, GA

Typically, READ and DATA are used to fill an array with data. They are also used to load in a list of numbers that will be used as sequential input for a single program variable.

In the case of loading arrays, Timex/Sinclair BASIC gives you a way to do without READ and DATA. For example, the standard BASIC program

```
10 DIM T(10)
20 FOR I=1 TO 10
30 READ T(I)
40 NEXT I
50 DATA 77, 83, 78, 86, 88
60 DATA 91, 90, 70, 76, 69
```

stores the listed values in the array T( ). Using a ZX81 computer, you would have to do the program as follows:

```
10 DIM T(10)
20 FOR I=1 TO 10
30 PRINT "ENTER NEXT
   NUMBER"
40 INPUT T(I)
50 NEXT I
```

However, you don't necessarily have to do this each time you run the program. When you save a ZX81 program on cassette tape, the program variables retain their contents. In this ex-

ample, you need type in the numbers only once before saving the program on tape. The next time you load the program, the array T( ) will automatically be filled with its original numbers. In fact, after you run the above program and before you save it on tape, you should delete lines 20–50 because the array will be filled with data automatically the next time you load the program.

If the program you want to run uses DATA to store sequential input values for one variable, the solution is not so easy. For example, this program

```
10 FOR I=1 TO 10
20 READ A
30 PRINT A "SQUARED IS" A*A
40 NEXT A
50 DATA 1.2, 3.7, 4.4, 5.5
60 DATA 7.0, 6.1, 8.8, 0.9
70 DATA 2.3, 10.1
```

requires that A take on the 10 values one at a time. Using the ZX81, you would have to include a series of statements like this:

```
20 LET A=1.2
21 LET A=3.7
```

and so forth, using one LET statement for each DATA item.

How useful are those power-line conditioners I see advertised? Don't personal computers have built-in protection against power-line irregularities? R.C. Cunningham, Claremont, CA

All personal computers include a certain amount of protection against sustained voltage drops or surges, the kind that result when heavy electrical equipment is in use somewhere in your building. Most personal computers can operate on line voltage from 10 to 20 percent above or below the nominal 110-volt AC rating.

Personal computers are more susceptible to sudden, occasionally extreme, fluctuations in voltage ("transients") caused by lightning strikes or the electrical "noise" of motors switching on or off. If the computer mistakes these transients for signals, it may malfunction. A few computers—Apple IIe, Apple Lisa, and Radio Shack TRS-80 Model III—contain line filters to help protect against such problems.

Whether you need a power-line conditioner depends mainly on your particular installation. If you're experiencing sporadic "hang-ups" or disk "crashes," chances are that noise on the power lines is causing your problem.

Prices of power-line conditioners range from as little as $10 to $100 and up, depending on the features they offer. Compare the following points when you're evaluating them:

- speed of response to voltage spikes
- ability to handle repeated, closely spaced voltage spikes
- maximum voltage level that can be suppressed
- total power-handling capability
- two-way protection to prevent one computer device from putting its own noise on the power line
- multiple outlets for connection of several devices

For further information on power-line conditioners, including a product-comparison chart, see "What Happens When the Lights Go Out?" (August 1982, page 97).

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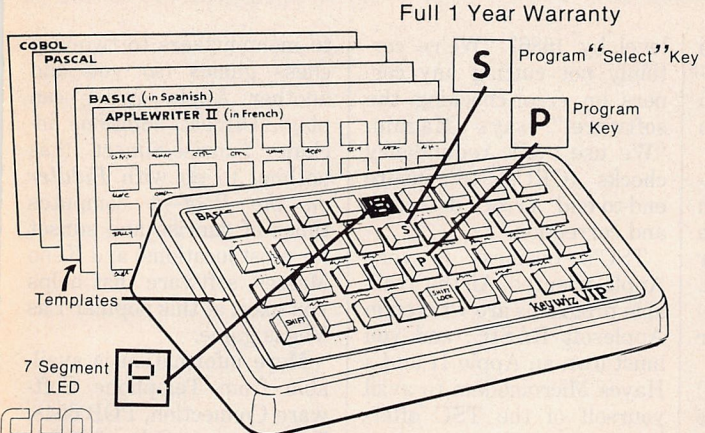

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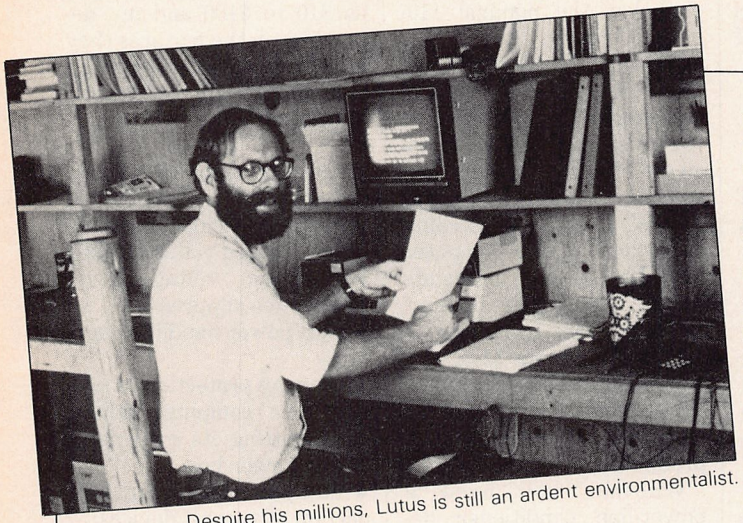

Despite his millions, Lutus is still an ardent environmentalist.

Will Success Spoil Paul Lutus?

When we last visited high-school dropout Paul Lutus (*Popular Computing*, February 1982), the reclusive super-programmer (Apple Writer, Appleworld, Graforth, Musicomp, etc.) was grinding out programs at the end of a 1300-foot extension cord in the cabin he built on a southwestern Oregon mountainside. Lutus was already beginning at that time to enjoy the fruits of his labors as his earnings approached six figures.

That has changed. Lutus figures his 1982 income was "a little over $1 million from Apple Writer alone." He has now incorporated himself (Walden Software Inc.), replaced his Cessna 172 airplane with a Mooney 201, and abandoned his cabin for a 2800-square-foot hacienda on a 32-acre spread at the foot of Oregon's Sexton Mountain. It's a bit of an upgrade from the cabin: three bedrooms (one of which is now his computer room), three bathrooms (he had none before), and a hot tub that has led him to dub the place his "swinging bachelor pad." (Paul says he hasn't thrown any parties himself, but he accommodates friends who "volunteer" his place for bashes that usually feature the hot tub.)

Despite all that, Lutus claims his life-style has changed very little. "My diet is still the same (mainly vegetarian), and I still cut my own firewood, only now it's for a fireplace instead of a stove. I have more room to move around, better classical records to listen to, and a lot of other trivial things like that, but I'm still basically a hermit," he says.

He is one of your richer hermits, though. He plunked down $240,000 cash for his new home and another $76,500 for the airplane. Don't worry, though. Lutus maintains his head hasn't been turned by sudden riches. "At this point I've bought the house and I've had my jollies with worldly goods," he says, adding that there are "no Ferraris" in his future. Instead, he's trying to thwart the tax man by giving away some of his loot. He wrote a check for $10,000 to a local affiliate of National Public Radio, and he donated his old airplane and old homestead—20 acres on Dollar Mountain—to The Nature Conservancy, a national organization dedicated to preserving the environment. He has also set up his own foundation to fund worthy social causes.

Professionally, Lutus continues to work on new versions of his Apple Writer programs and graphics packages. He abandoned work on a word processor for the IBM PC last year after he and IBM failed to agree on a royalty contract. He's turned instead to the Commodore 64 because very few software packages take advantage of its excellent graphics and music capabilities. Making computing more exciting for beginners remains Lutus's first love. "That's my favorite kind of programming," he says.

Downloader's Supermarket

In our May 1982 issue (page 26), we introduced readers to the Telephone Software Connection, a Torrance, California, firm in the business of downloading software from its computers to yours. Since that report, TSC president Ed Magnin reports that the company's product line has expanded to meet the growing needs of downloaders in all 50 states, as well as Canada, Mexico, Europe, and Asia. There's even a brisk market in Australia among the "downloaders down under" who don't want to drive to Melbourne for software.

This multicontinental enthusiasm has a lot to do with what TSC *doesn't* charge the user for: no membership or connect-time fees are levied. You pay only for the software, same as in computer stores.

Does this mean that TSC is getting to be the Macy's bargain basement of software merchandising—a field that Future Computing Inc. predicts will hit the $4 billion level by 1986? "We're certainly not cutting any corners on error-checking the software," says Magnin. "We use cyclic redundancy checks (CRCs) to ensure end-to-end error detection and correction."

TSC's business is very Apple-oriented. All the available programs are written in Applesoft BASIC, and you must own an Apple II and a Hayes Micromodem to avail yourself of the TSC offerings.

The TSC library now includes everything from terminal-emulator programs to menu-makers to two-way chess games (so you and another Apple owner can play). Offbeat additions include Sunrise/Sunset (has nothing to do with *Fiddler on the Roof*—it computes times of sunrise and sunset for most locations) and Keno Master, software that helps you excel at this popular Las Vegas game.

More information is available from Telephone Software Connection, POB 6548, Torrance, CA 90504. Phones: modem, (213) 516-9432; office, (213) 516-9430.

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TV Watchdogs Create Database of Advertisers

The Coalition for Better Television (CBT), the group whose threats of an advertiser boycott in 1981 prompted Procter & Gamble to change its advertising policy, has purchased an IBM 34 mainframe to process its watchdog reports. Each month some 800 reports are received at the Tupelo, Mississippi, headquarters of the National Federation for Decency, CBT's parent organization. According to CBT's chairman, the Rev. Donald Wildmon, the new computer will speed up the processing of what he terms the "buzzard reports." A "buzzard" is any advertiser that swoops down to buy spots on, for example, "Three's Company" or "Soap" reruns—shows that the CBT finds highly objectionable.

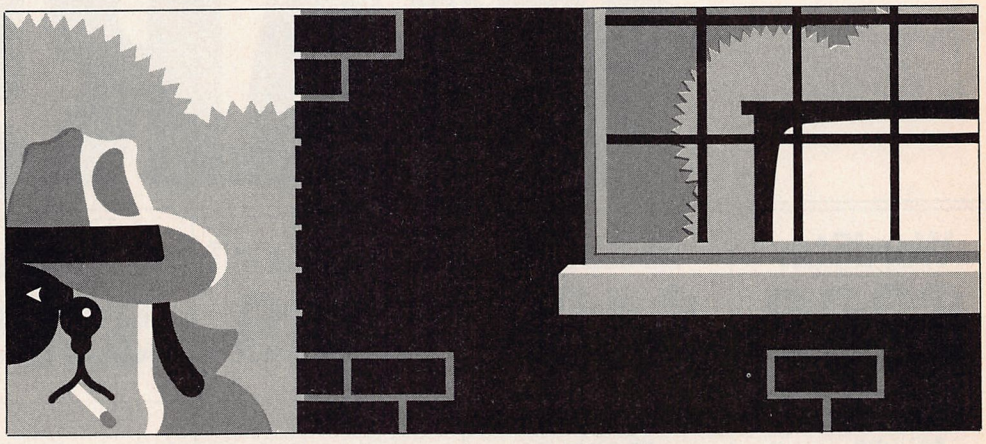
"The computer lets us quickly update the files on advertisers," says Wildmon. "We'll be able to stay up to the minute on how much sex, violence, and profanity they sponsor. Plus we can keep records on the ratio of TV characters' alcohol consumption to the intake of other beverages." (Wildmon maintains that it's rare to see a character drinking a glass of milk on TV.)

"Network advertising time usually costs about $200,000 a minute," says Wildmon. "But there are certain shows, known as 'distressed merchandise' in the advertising business, where airtime costs only $50,000 or $60,000 per minute." As a program's ratings tumble, the subject matter tends to get more sexually provocative or violent in an effort to hold its viewers. "Many advertisers won't touch distressed merchandise such as "Three's Company," but some care only about the cost-per-minute," Wildmon claims.

Many producers and performers resent Wildmon's scrutiny. Katharine Helmond, one of the stars of "Soap," has maintained that CBT's pressure on advertisers—not poor ratings—caused the cancellation.

"Suppose an advertiser claims it's going to change its policies," Wildmon continues. "With the computer, we can check two months or two years down the road to see if the advertiser really did change."

In addition to its primary use, the advertiser database may be of financial value to the coalition as well. "It'll be a vast database," Wildmon emphasizes. "Coca-Cola might be interested to know how much airtime Pepsi bought in '82. Procter & Gamble might want to look for trends in what Colgate-Palmolive is buying. To my knowledge, they can't get that online information anywhere else."



Thames TV Bombs With Computer Shows

Last year the British Broadcasting Corporation aired a series of programs designed to introduce its viewers to the joys of computer programming. Critics and viewers alike were ecstatic. That prompted Thames Television, the BBC's rival network, to launch its own series about microcomputing. But this time critics assailed the programs. The first two installments—entitled "Database"—were deemed "absurd" by one British computing journal. Viewers were more baffled than enlightened by the sight of a chimpanzee playing "arithmetic bingo" with Dr. Mike Thorne of Cardiff University. (The simian showed a surprising gift for math as he pawed a Texas Instruments computer.)

Some viewers were incensed because the programs aired too late at night (11:30 p.m.) for children to watch. Many advertisers withheld support because of the late-night slot.

"If Thames TV does repeat the idea," says one publicity director for a British hardware vendor, "we are looking for an earlier air time, better presenters, and networking outside the immediate London area. All in all, the shows were a bit patchy."

If "catchy" doesn't replace "patchy" next time around, most viewers in the U.K. will continue to rely on the BBC for computing news and views.

Britain's Personal Computer Network

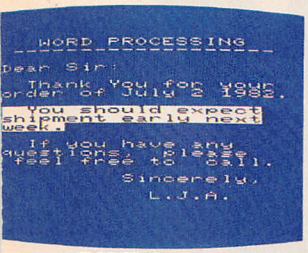
Need a new software program tonight, but the store is closed? Seen an ad for a package that sounds good, but you're not sure? Want a special program, but it won't run on your computer? If you were in Britain, these situations wouldn't cause you any problems.

A new service for microcomputer users called Micronet 800 solves all these dilemmas and adds an array of other goodies at a very affordable price.

Kicking off this year with half a million dollars' worth of advertising in the *Times Educational Supplement* and 16 computer magazines, Micronet 800 hopes to attract 100,000 of England's personal computer users to a network for business, education, and entertainment. Partners in the venture are the British telecommunication agency's Prestel, East Midlands Allied Press, and Prism Microproducts.

Illustrated by Daniel Pelavin

IF YOU OWN A COMMODORE COMPUTER, YOU KNOW IT CAN DO ALL THIS.



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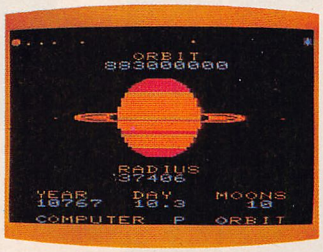

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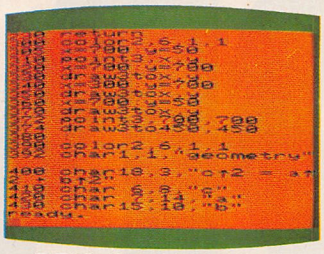

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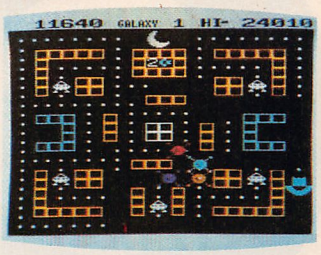

GAMES

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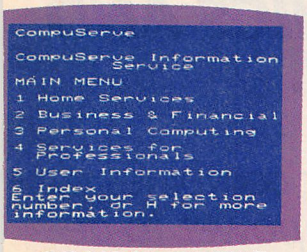

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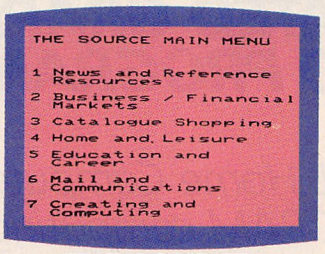

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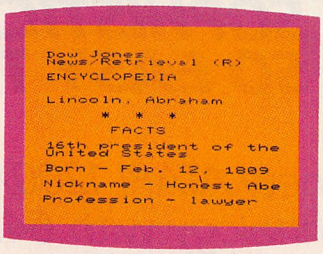

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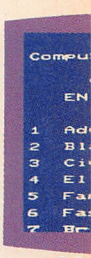

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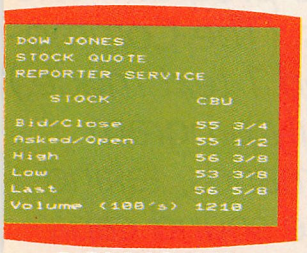

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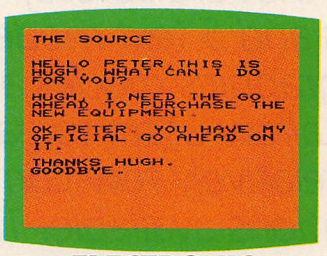

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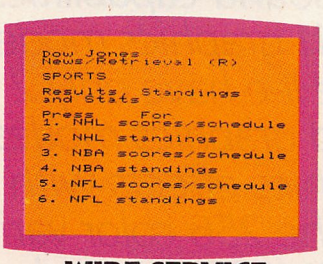

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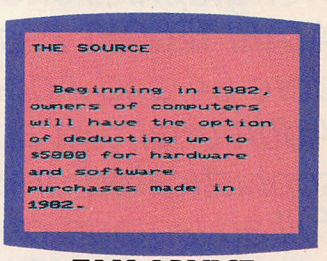

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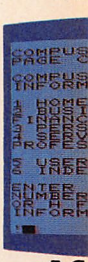

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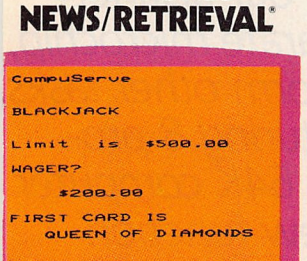
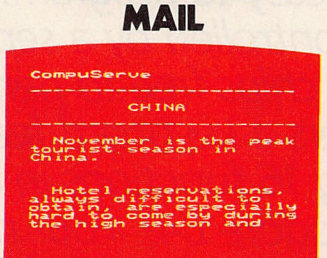


GAMES



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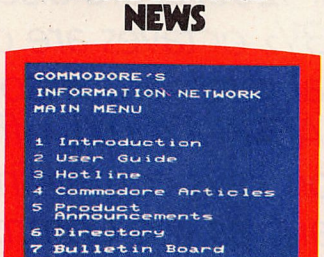

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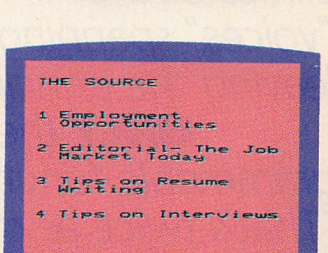

EMPLOYMENT OPPORTUNITIES

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key permits users to self-test ROM, RAM, audio-visual circuitry and keyboard functionality or call up assistance within complex programs. For even more help, Atari gives you a toll-free number to call for product and technical information (800) 538-8543; in California 1-(800) 672-1404.

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HOME COMPUTER

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Business applications include an electronic mail system that enables a member to exchange messages with any other Micronet or Prestel subscriber, expediting communications with customers, dealers, and suppliers. This is like the mailbox offered by The Source, but it costs less. Advertisements have promised a "constantly updated reference source" that aids comparison shopping by supplying software reviews, dealer and price information, and advice on best buys. Subscribers will find classified ads for jobs, services, and used equipment for sale or swap, and they can place orders electronically by credit-card number. Also, each member gets a number and a password, thus preventing unauthorized access to personal messages.

Educational applications include correspondence and self-teaching courses, exchanges of programs written by teachers and students, and bulletin boards offering the news, notes, and reference services of the Amateur Computer Club and its Apple, Commodore, Sinclair, Texas Instruments, TRS-80, and other affiliated user groups.

Entertainment comes in the form of nearly 100 free games and quizzes with unspecified "big prizes." All members can access Prestel's 200,000-plus pages (80 percent of them free) on travel, holidays, finance, films, theater, records, news, sports, museums, and services offered by local, regional, and national governments.

The application with the greatest potential for growth is *telesoftware*, the transmission of programs from one computer to another by television, radio, or (in this instance) telephone lines. With telesoftware, programs can be ordered and delivered by telephone without any shipments of disks or cassettes. The telephone company will collect from buyers and remit the sales price to the software publishers.

The BBC's Ceefax and British commercial TV's Oracle one-way teletext services have long been sending software programs over the air. The Netherlands World Service shortwave radio has transmitted experimental weather and navigation software, and 25 schools and colleges have taken part in a two-year Council for Educational Technology telesoftware trial. But according to Tony Sweet of Prestel, fewer than 200 personal computers in the U.K. had the special software packages that would enable them to download these telesoftware programs.

This is where Micronet 800 can fill a void—the hardware and software needed to download telesoftware come with membership. A new member pays the equivalent of $85 for entry software and an adapter that connects his or her computer to the telephone (these items are reported to cost $250 retail). After this start-up fee, a member pays under $2 per week plus telephone charges. It's estimated that 92 percent of Great Britain's population can use Prestel/Micronet at local phone rates that, as in the United States, are lower during evenings and weekends. Central mainframe computers check every individual use and show the cost at the end of each session.

Prime movers Richard Hease of East Midlands Allied Press and ECC Publications and Robert Denton of Prism Microproducts predict that by the fourth quarter of this year there will be "in excess of one million" personal computers in use in England and that one out of ten will belong to Micronet 800.

When the Gifted Get Computers

We've all attended parties where someone blurts, "I can't get excited about computers because you have to be a genius to learn programming." While this contention is patently false, there *is* one user group composed exclusively of geniuses: Mensa's Computer Hobbyist special interest group. Mensa is an international organization with one simple eligibility requirement: to join you must submit proof that you've scored in the 98th percentile or above on one of the standardized IQ tests. (The name Mensa—Latin for "table"—reflects the organization's credo that geniuses are equals, just like the Knights of the Round Table.)

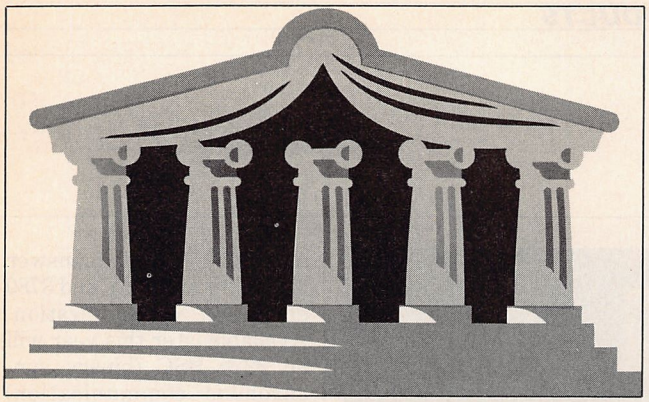
"We haven't hooked up our computers to solve all the world's problems yet," chuckles Garrett Davis, chairman of the special interest group. "We have the same problems as any other user group. Mostly we trade information and advice."

Perhaps Davis is being a bit modest. Dick Amyx, editor of the group's newsletter, notes that several members are using microcomputers to do what's expected of geniuses—have fun and make money. "One member is into horse-race handicapping," says Amyx. "His program has caught the interest of a number of people who are interested in horse racing, computers, and a fast buck. Another member has come up with good software for predicting stock market trends."

The Computer Hobbyist group is a spin-off of an older Mensa clan established for computer professionals. The newer group lets Mensans ask questions that the data processing pros couldn't answer. The club's two ranking members are 1980s-style entrepreneurs. Davis, a former accountant, designs and sells accounting software through his own company. Amyx works as a tech-writing consultant in Silicon Valley.

Davis is at a loss to explain why renowned computer designers Clive Sinclair and Adam Osborne, both Mensa members, are not affiliated with the Computer Hobbyist group. One member's explanation: "They're too busy making money, I suppose."

For more information about Mensa and the Computer Hobbyist special interest group, write to Mensa, Dept. PC, 1701 West 3rd St., Brooklyn, NY 11223.



Computers Examine Ancient Literature

"It's really quite ironic," says Lee Pearcy Jr., assistant professor of classics at the University of Texas at Austin. "We're using twentieth-century technology—namely, the computer—to discover new things about writings that date back to the third century A.D." In addition to teaching UT's Computers in Classics graduate course launched last fall, Pearcy is director of computer activities for the classics department, a discipline that ranks fifth (behind the computer science and several engineering departments) in computer time logged at the university.

Using a high-level language called Ibex—a language noted for its rapid string searches—Pearcy's students write programs that help them analyze the writings of Aristotle and Homer, among others. The department's Ibycus system, software from Ibycus Corp. that runs on a Hewlett-Packard 1000 minicomputer, lets a student search the entire *Iliad* for character strings in just 7 seconds.

"Academicians have coined the term 'stylometrics' to refer to scholarly analyses of how a writer's style changes over the course of a lifetime," Pearcy explains. "For example, a young writer may begin sentences with 'however,' and by age 50 he may unwittingly be inserting the 'however' in midsentence. We've used the computer to analyze how Aristotle's writing changed as he grew older." (If reprogrammed, Ibycus could presumably add fuel to the Shakespeare plagiarism debate by scanning for passages in the Bard's works that match the style of Christopher Marlowe.)

The Ibycus system's shining hour came last fall, when it helped Pearcy's students pinpoint the origin of a poem written on a piece of Egyptian papyrus that dates back to the third century A.D. "Some scholars surmised that the quotation (in Greek) was from the *Iliad*," Pearcy recalls. "The passage contained the words 'sword' and 'blood,' so we used the computer for a string search of the *Iliad* and, sure enough, the words were from Homer's epic."

Dr. Pearcy, who describes himself as a "self-taught hacker," reports that most of his students are as excited about computing as they are about Vergil and Horace. "One of the greatest cons of the twentieth century is that people in the humanities can't understand computers," he says. "But all you really need is enthusiasm—and a few good manuals."

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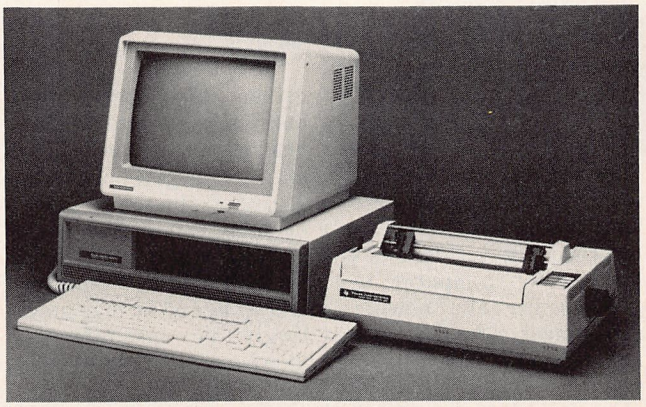
TI's Professional Computer

Texas Instruments has introduced the Professional Computer, a 16-bit desktop unit targeted squarely at the IBM Personal Computer market. The Professional Computer has been called an IBM look-alike, but the Intel 8088-based machine offers several features not found on the Personal Computer including a voice-recognition system and a "natural language" interface.

The voice-recognition system, scheduled for release later this year, will permit you to give a limited number of spoken commands to a spreadsheet application, for example, which will then perform the desired functions. The system will also perform telephone dialing and answering tasks.



The TI Professional Computer with optional monitor and printer.

The natural-language feature lets you instruct the computer with ordinary sentences. You construct sentences by choosing words displayed in windows on the screen.

The Professional Computer offers high-resolution graphics on either a 12-inch monochrome display or an optional 13-inch color display. Both displays use the same format: 80 columns, 25 lines, and 720 by 300 pixels with the graphics-controller option. Thus you can run applications programs with either display without modification.

The company is also offering internal modems with automatic dial and answer capability and TTY and 3780 emulation communication. Available later this year will be 3270 BSC (binary synchronous communication) and SNA (system network architecture), 3101 emulation, and communications to the TI business-systems series of minicomputers.

Software available for the Professional Computer includes over 100 applications programs for accounting, financial planning, database management, graphics, and word processing including offerings from Ashton-Tate, Digital Research, Lifeboat, Micropro, Peachtree, and Visicorp. Integrated packages including 1-2-3 from Lotus and Visi On from Visicorp are under development for introduction later in 1983. In addition, the Professional Computer supports four 16-bit operating sys-

Getting More for Less

The Timex/Sinclair 2000 is the first microcomputer with 48K bytes of random-access memory (RAM) to sell for less than $200. The TS2000 offers high-resolution color graphics, programmable sound, and a full-travel membrane keyboard.

Priced at $199.95, the machine also includes a 10-octave sound generator, eight different colors, separate controls for foreground, background, and border areas, as well as a flash command and brightness control. The Z80A-based computer has a display area of 24 lines by 32 characters and a graphics resolution of 256 by 192 dots. A built-in cassette interface lets you save programs and data on standard audio cassettes. An RF (radio frequency) modulator is also included. A version of the TS2000 with 16K-byte RAM costs $149.95.

In addition to audio cassettes, the TS2000 uses a series of solid-state cartridge programs that plug directly into the computer. With prices ranging from $9.95 to $24.95 each, the cartridges cover a wide variety of applications including entertainment, education, business, and personal financial management.

Along with the TS2000, Timex/Sinclair is introducing a thermal printer that's compatible with both the new computer and the earlier TS1000. The Timex/Sinclair 2040 ($99.95) features dot-matrix printing, full text and graphics capabilities, 32 columns per line, a print speed of two lines per second, and program-controlled printing. The TS2040 can also print an entire screen of text or graphics with the touch of a single key. The printer connects

tems: MS-DOS, CP/M-86, Concurrent CP/M-86, and the UCSD p-System. And using a softcard from Xedex Corporation, the computer can run CP/M-80 programs.

The TI Professional Computer is currently available for $2595 for the basic system consisting of a monochrome display, keyboard, 64K bytes of random-access memory (RAM), and an integral 320K-byte floppy-disk drive. You can upgrade the system with additional memory, mass storage, communications, and other options. A typical system configuration with a 13-inch color monitor, 256K-byte RAM, one 320K-byte floppy drive, and one 5-megabyte hard-disk drive sells for $6185.

For details, write Texas Instruments, Data Systems Group, POB 402430, H-651, Dallas, TX 75240.

Circle 200 on inquiry card.

Portable Pied Piper

The Pied Piper I comes with a carrying case for easy transporting between home and office.

The Pied Piper I is a low-cost ($1299) portable computer designed for small-business applications. Weighing less than 15 pounds, the unit comes in a low-profile carrying case.

Features include a full ASCII (American National Standard Code for Information Interchange) keyboard, a built-in RF (radio frequency) modulator, a 5¼-inch 256K-byte disk drive, a two-card expansion slot, a parallel-printer interface, 64K bytes of random-access memory (RAM), a Z80A microprocessor, and an 80 by 24 video-monitor interface. Options include a two-line liquid-crystal display, an RS-232C serial port, as well as a telephone modem.

The Pied Piper I also includes the CP/M operating system, Wordstar, Mailmerge, BASIC, an electronic filing program, an electronic spreadsheet, and a terminal emulator. For more details, write STM Electronics Corp., 525 Middlefield Rd., Suite 130, Menlo Park, CA 94025.

Circle 201 on inquiry card.

easily, features an on/off switch, and is built in a housing designed for quiet operation.

Further information on all Timex/Sinclair products is available from the Timex Computer Corp., (800) 248-4639.

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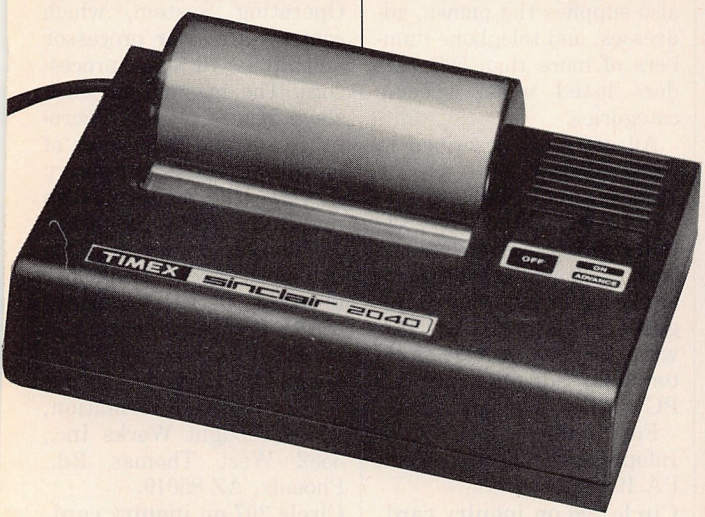
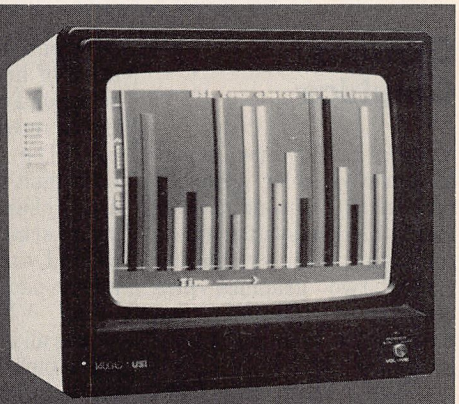


The Big Picture



USI International has added a 14-inch composite-video color monitor to its line of display units. Priced at $399, the monitor offers a large, bright image with low distortion, thanks to quality components and the inherent advantage of composite-video over television-type signals. The company says the unit is ideal for graphics applications as well as standard uses. Each display is tested for 100 hours and completely inspected prior to shipment.

For further details, write USI International Corp., 71 Park Lane, Brisbane, CA 94005.

Circle 203 on inquiry card.

Were You Talking to Me?

Milton Bradley's Expander system allows voice control of the TI-99/4A microcomputer.

It used to be that people who talked to their computers were regarded as, well . . . strange. Now, thanks to Milton Bradley's Expander system, talking to a computer is quite acceptable and a lot of fun too.

Designed for the Texas Instruments TI-99/4A computer, the Expander interfaces with a new series of game and learning cartridges that react to your voice input. Included with each system is a 64-key keypad with provision for instruction overlays, a triple-axis joystick, and a headset microphone for voice command. The $100 Expander also features its own built-in speech synthesizer.

For more details, contact the Milton Bradley Co., Springfield, MA 01101.
Circle 204 on inquiry card.

The Vectrix VX128 graphics workstation with optional keyboard.

Glorious Graphics

Vectrix has unveiled a pair of low-cost color graphics processors. Intended primarily as displays for a host computer, each system includes two graphics processors, a red-green-blue monitor, a printer, and a keyboard.

Using NEC's new GDC chip and an Intel 16-bit 8088 microprocessor, the VX128 ($1995) contains features usually found only on machines costing substantially more. Among its features are a 672- by 480-dot resolution; eight simultaneous colors; three-dimensional vector graphics with rotation, scaling, translation, perspective, clipping, viewport, polygons, and filled polygons; high-speed generation of lines and arcs; plus serial and parallel interfaces that connect to most computers. The system includes both built-in and user-definable characters; variable zoom; slant and tilt; horizontal and vertical spacing; and a light-pen interface.

The VX384 ($3995) includes all of the VX128's features plus the ability to generate 512 simultaneous colors. This capacity enables the VX384 to produce subtle shading of three-dimensional objects and produce bit-plane animation for three-dimensional solid modeling, presentation graphics, image processing, and other sophisticated applications. For details, contact Vectrix Corp., 700 Battleground Ave., Greensboro, NC 27401.
Circle 205 on inquiry card.

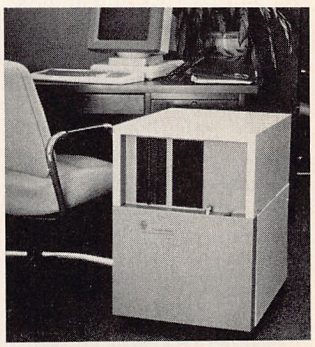
IBM Directory

The Directory of Independent IBM Personal Computer Hardware and Software is a publication designed to aid IBM Personal Computer users by providing detailed descriptions of third-party (non-IBM) products for their machine. The directory, which comes in a vinyl loose-leaf binder, contains over 150 pages of descriptions and reviews of software and hardware for the PC. In addition to detailed summaries of each product, the $29.95 directory also supplies the names, addresses, and telephone numbers of more than 500 vendors listed under specific categories.

All software described in the directory runs on the IBM PC-DOS operating system. Among the software characteristics covered in the book are hardware and memory requirements, source language, and pricing. All hardware profiled in the directory plugs directly into the PC without modification.

For more details, write Infopro, POB 22, Bensalem, PA 19020.
Circle 206 on inquiry card.

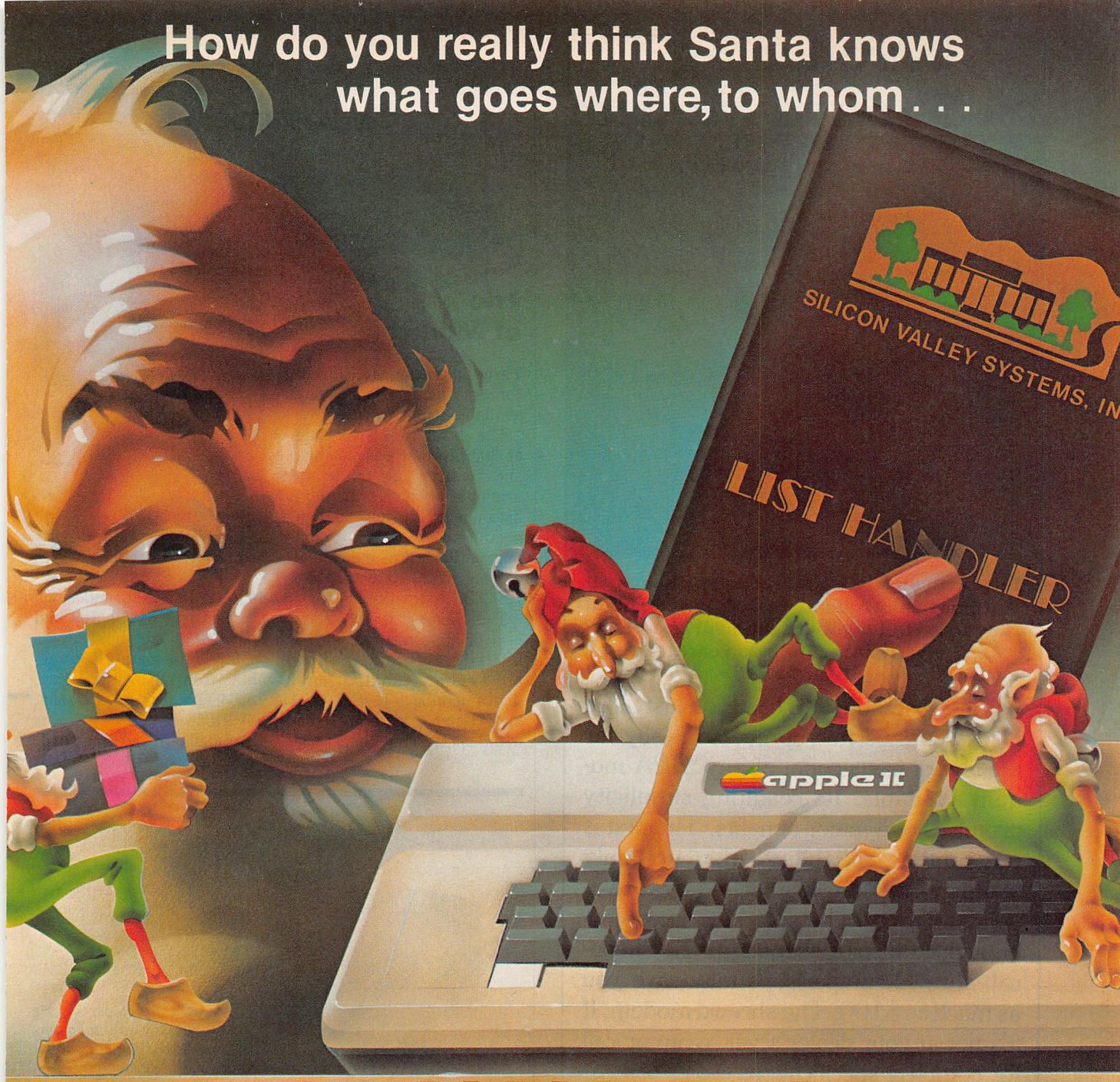
Multiuser Computer



Thought Works has introduced the TW-800, a CP/M-compatible small computer that accommodates up to 12 terminals and 20 printers. The TW-800 offers an 8-inch disk drive, 18 S-100 slots, two RS-232C serial ports, two parallel ports, an on/off switch, and a power supply.

The 8-bit computer uses the TurboDOS Network Operating System, which controls a master processor and up to 16 slave processors. The master and each slave include a Z80A microprocessor and 64K bytes of random-access memory (RAM). The basic system retails for $9275; a totally configured 10-user installation costs about $2100 per terminal. Options include a second floppy-disk unit and a hard-disk drive with cartridge-tape backup.

For more information, write Thought Works Inc., 3532 West Thomas Rd., Phoenix, AZ 85019.
Circle 207 on inquiry card.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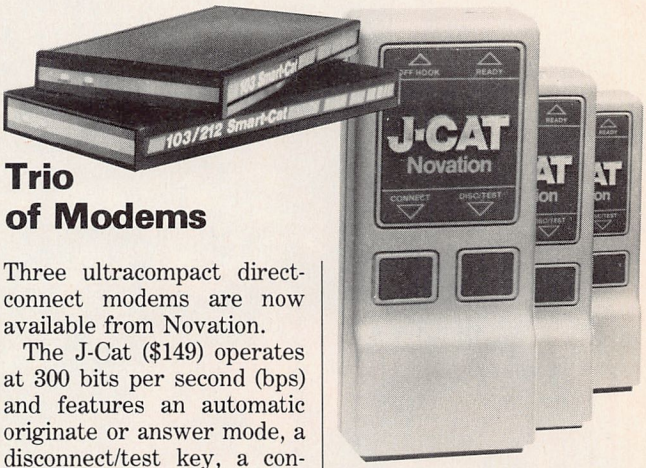

Novation's J-Cat, Smart-Cat 103, and Smart-Cat 103/212.

Trio of Modems

Three ultracompact direct-connect modems are now available from Novation.

The J-Cat ($149) operates at 300 bits per second (bps) and features an automatic originate or answer mode, a disconnect/test key, a connect/break key, two communication status indicators, a busy-signal detector, and RS-232C compatibility.

The Smart-Cat 103 ($249) is a 300-bps modem with a built-in dialer, auto-answering, analog and digital loopback testing, and an extensive software command set. The Smart-Cat 103/212 ($595) includes all the features of the 103 and operates at 1200 bps.

More information is available from Novation Inc., 18664 Oxnard St., Tarzana, CA 91356.

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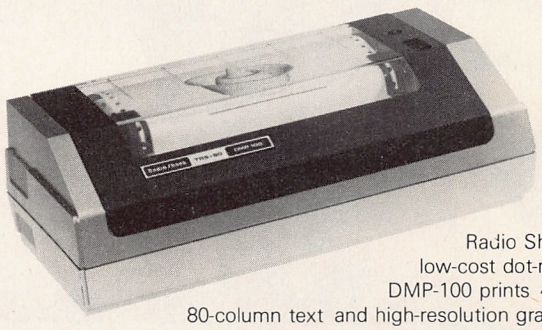

Radio Shack's low-cost dot-matrix DMP-100 prints 40- or 80-column text and high-resolution graphics.

Low-Cost Printer with Graphics

Radio Shack's DMP-100 is a low-cost dot-matrix printer with graphics capability. The unit features 5 by 7 dot-matrix, upper- and lowercase characters; an 8-inch print line; underlining capability; and a user-selectable 40- or 80-column print mode.

The DMP-100 prints 50 characters per second in the 80-column setting and has a bit-image mode that prints fully addressable, high-density graphics. Using an optional program, the DMP-100 can produce black-and-white graphics copied from the TRS-80 Color Computer screen display.

Included with the printer is a 480-byte dot buffer, selectable parallel and serial interfaces (600/1200 bits per second), and a 4½- to 9½-inch adjustable tractor-feed mechanism that can accommodate fanfold paper up to 9½ inches wide. The unit is priced at $399. For details, write Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102.

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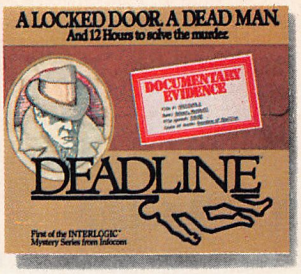

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TRS-80 Model 12 and Hard-Disk Drive

The TRS-80 Model 12, shown here with the 12-Megabyte Hard Disk, is Radio Shack's latest small-business computer.

The TRS-80 Model 12 is Radio Shack's latest entry into the professional and small-business computer market. Featuring a Z80A 8-bit microprocessor, 80K bytes of random-access memory (RAM), and one or two built-in 1.25-megabyte 8-inch floppy-disk drives, the computer is compatible with all Model II software. The system's new TRSDOS 4.2 disk operating system—an enhanced version of TRSDOS 2.0—supports double-density and single- or double-sided disks.

The Model 12 is equipped with a 12-inch green-phosphor monitor that displays 40 or 80 characters in each of its 24 lines. The system features upper- and lowercase characters plus 32 business graphics characters. Its detachable, low-profile keyboard offers 82 keys, including a numeric keypad and eight programmable-function keys.

With the installation of an optional card cage, the Model 12 can accept up to six plug-in expansion boards. Among the boards available are a Visicalc memory-expansion board that increases RAM to 144K bytes, a high-resolution graphics board, and a Model 16 upgrade kit that gives the Model 12 a 16-bit MC68000 microprocessor and expands the RAM to 512K bytes. The Model 12 has a standard parallel-printer port, two RS-232C serial communications ports, and one external disk port. A Model 12 with a single floppy-disk drive retails for $3199; a two-disk version costs $3999.

In addition to the Model 12, Radio Shack is unveiling its 12-Megabyte Hard Disk. The drive features an advanced operating system with new user-friendly features as well as TRSDOS library commands currently available. Up to three secondary drives (each with an additional 12 megabytes) can be added for a total of 48 megabytes of online storage. The unit can be used with Radio Shack's Model II, Model 16, and Model 12 microcomputers and is compatible with most software for each of these computers.

The 12-Megabyte Hard Disk has a three-platter, six-surface 5¼-inch drive with a self-contained, recirculating air system. Each of the disk surfaces has one movable read/write head with access to 230 data tracks. Data is transferred at a rate of 5 megabits per second. A primary 12-Megabyte Hard Disk costs $3495; secondary units are available for $2495.

For details on the Model 12 and the 12-Megabyte Hard Disk, write Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102.
Circle 210 on inquiry card.

Enhance your Commodore 64 or VIC-20 with the HES Modem, Soundbox, and HES Stick I.

Peripherals for Commodore

A variety of products for the Commodore 64 and VIC-20 computers is now available from Human Engineered Software (HES).

The direct-connect HES Modem I ($79.95) ties a Commodore 64 or VIC-20 to other computers via telephone lines. Communication rate is 300 bits per second (bps), and the package includes terminal software.

HES Card is a VIC-20 expansion board that includes four switchable slots and a reset button. The board has high-reliability gold-plated edge connectors. Retail price is $29.95.

Soundbox ($14.95) improves Commodore 64 and VIC-20 sound output for arcade games. Also compatible with Atari and Texas Instruments computers, Soundbox includes such features as audio out, video out, and audio in.

The HES Stick I ($7.95) is a joystick controller for the Commodore 64 and VIC-20. The unique full-length fire button on the HES Stick I is designed for either left- or right-hand use. The joystick is suited for games or graphics applications and features a smaller chassis to reduce hand fatigue. HES Stick 1 is also compatible with all Atari computers.

Full details on the entire HES hardware and software product line are available from Human Engineered Software, 71 Park Lane, Brisbane, CA 94005.
Circle 211 on inquiry card.

End of the Hunt

All too often computer users ask, "What's on this disk?" Now IBM Personal Computer owners can use their computer to print orderly, alphabetized disk labels with the Label Kit PC Disk Organizer.

Selling for $59.95, each Label Kit comes with a program disk, 300 5-inch pin-feed labels, and complete instructions. To use the package, you simply slip the program disk into the drive, type the names of the programs on your disks, and watch the printer generate the labels. System requirements consist of a printer, a Personal Computer with 64K bytes of random-access memory, and a disk drive.

The Label Kit PC Disk Organizer is available from the PC Goodie Co., 15445 Ventura Blvd., Suite 10, Sherman Oaks, CA 91413. □
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CBM 1520 Plotter	259
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SOFTWARE FOR CBM 64

Word Processing (WordPro 3+)	$ 69
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Writer's Assistant (easy and flexible)	99
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80 Column Expander	$159
VIC 1600 Modem	95
VIC 1650 (auto answer, auto dial)	150
VIC 1525 Graphic Printer	329
VIC 1530 Datasette Recorder	65
VIC 1541 Disk Drive	329
VIC Switch (connect 8 64's or Vics to printer, dd)	149
IEEE Interface (64)	85
PET-IEEE cable	33
IEEE-IEEE cable (2m)	39
Parallel Interface (Epson, Okidata, IDS, NEC)	80
RS-232 Printer Interface (Okidata, Diablo, etc.)	60
Programmers Reference Guide	18
Verbatim Diskettes (10 per box)	26
Victree (Programmers Utility)	75

VIC PRODUCTS & ACCESSORIES

8K RAM Memory Expansion Cartridge	$ 40
16K RAM	70
24K RAM	105
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VIC 6 Slot Expander	70
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Gorf (64 also)	30
Omega Race	30
Arcade Joystick - Heavy duty w/2 firing buttons! Great for the VIC or 64	25

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Amdek Color I	$ 319
Amdek II or III	call
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Video/Audio Cable	15

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CBM 8300, 40 cps	$1450
Diablo 620, 25 cps	995
ComRiter, 17 cps	899
Transtar 130, 16 cps (auto load, wp features!)	769
NEC 7700 series	2350
NEC 3500 series	1600

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Okidata 92	559
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Business

Agristar—An information service for professional farmers, ranchers, agriculture specialists, and farm managers. With the use of a modem, Agristar provides a variety of information related to weather, marketing, finance, news, business and production technology, communications, electronic mail, and online timesharing of farm-management models. For the **TRS-80 Models II** and **III**; $199.95. Requires a modem. Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102.

The Apartment House Manager—A program for apartment building managers. Allows you to check on the status of each apartment, keep a journal of all rents and expenses, and review monthly profits and losses. The system also prints rent rolls, monthly rent bills, form letters, leases, and notices of nonpayment. For the **IBM Personal Computer**; $395. Requires 48K bytes of memory. User-Friendly Software Inc., POB 1192, Melville, NY 11747.

A. S. K.—An assessment survey kit program designed for people who use questionnaire surveys in training, personnel, or market research. The program is user-defined and lets you modify, add, or delete questions at any time. You can display statistical results for review and then print a complete summary report. For the **Apple II** and **III**; $295. Albrecht & Associates, POB 99097, San Diego, CA 92109.

Calc Result—A spreadsheet program with 32 pages of 63 by 254 cells. Calc Result can produce graphics on a screen and on a printer and has the ability to let you view up to three spreadsheets at a time. For the Commodore **CBM 8032** and **8096**; $199; and the **Commodore 64**; floppy disk or cassette, $149.95 and $69.95, respectively. Computer Marketing Services Inc., 300 West Marlton Pike, Cherry Hill, NJ 08002.

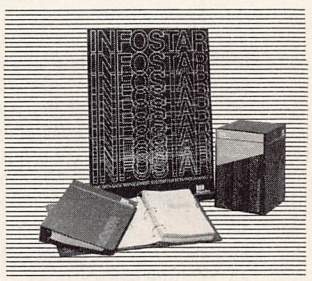
CPApartner—A client write-up and billing system for small- to medium-sized accounting firms. This menu-driven program consists of two modules; one for time management and billing and one for client write-up. It can handle up to 500 clients with maximum of 4500 monthly journal entries per client. For the **Apple II** and **III**; $1295. Client write-up module alone, $695. Starsoft, Suite 125, 4984 El Camino Real, Los Altos, CA 94022.

The Data Reporter—A database management program that is easily tailored to meet your specific needs. This menu-driven system features search and sort routines, file merge, a reformatter, global editing, a label-making utility, and data calculation abilities. For the **IBM Personal Computer** with 64K bytes of memory and PC-DOS; $250. Synergistic Software, Suite 201, 830 North Riverside Dr., Renton, WA 98055.

Electronic Broker—A program for stockbrokers, investment advisors, accountants, and small bank trust departments. Maintains securities transaction records and organizes related accounting information. The package includes a client accounts library, a securities library, an ongoing transactions file, and a matched-off liquidations file. For **TRS-80 Model II**; $995. Radio Shack (see address above).

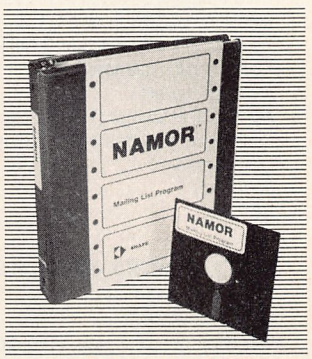
Graphwriter—A business graphics and plotter package designed to produce high-quality pie, bar, and line charts plus a wide selection of others. The program is menu-driven for easy selection and provides help messages to guide you through difficult spots. Charts of virtually any size can be created. For the **IBM Personal Computer** with 128K bytes of memory, two double-sided disk drives, and Hewlett-Packard **HP7470A, HP7220,** or **IBM XY/750** plotters; $395. Graphic Communications Inc., 200 Fifth Ave., Waltham, MA 02254.

Infostar—A database management system designed for nonprogrammers. This easy-to-use program provides menus in plain English and guides you through the process of information input. Once information has been entered, you can sort or manipulate data any way you want and produce reports in approximately 60 seconds. For **CP/M-based** systems; $495. Micropro International Corp., 33 San Pablo Ave., San Rafael, CA 94903.



Mathlib—A series of five programs for engineering or scientific applications. Mathlib provides the solutions to linear, nonlinear and differential equations, polynomial roots, and function plots. Also included in the package is a clock that chimes on the hour and quarter hour. For the **Atari 400** and **800**; floppy disk or cassette; $60. M. S. Hundal, RFD #1, Box 46, Milton, VT 05468.

Namor—A mailing-list program with five menu-driven screens that eliminate the need to remember special instructions and codes. Includes standard mailing-list features plus a separate formatting program that allows the list files to be used with other word processors. For **CP/M-** or **MP/M-based** systems; $150. Manual and training/demonstration disk alone, $25. Shape Inc., Suite 615, 122 Spanish Village, Dallas, TX 75248.



New Software provides up-to-date listings of the latest releases in microcomputer software, grouped into seven categories: Business, Games, Home, Education, Programming Languages, Word Processing, and Technical Tools. New Software listings are based on product information supplied by the manufacturers and should not be considered endorsements of the products listed. For in-depth evaluations of the most important and interesting new releases, read our Software Review section.

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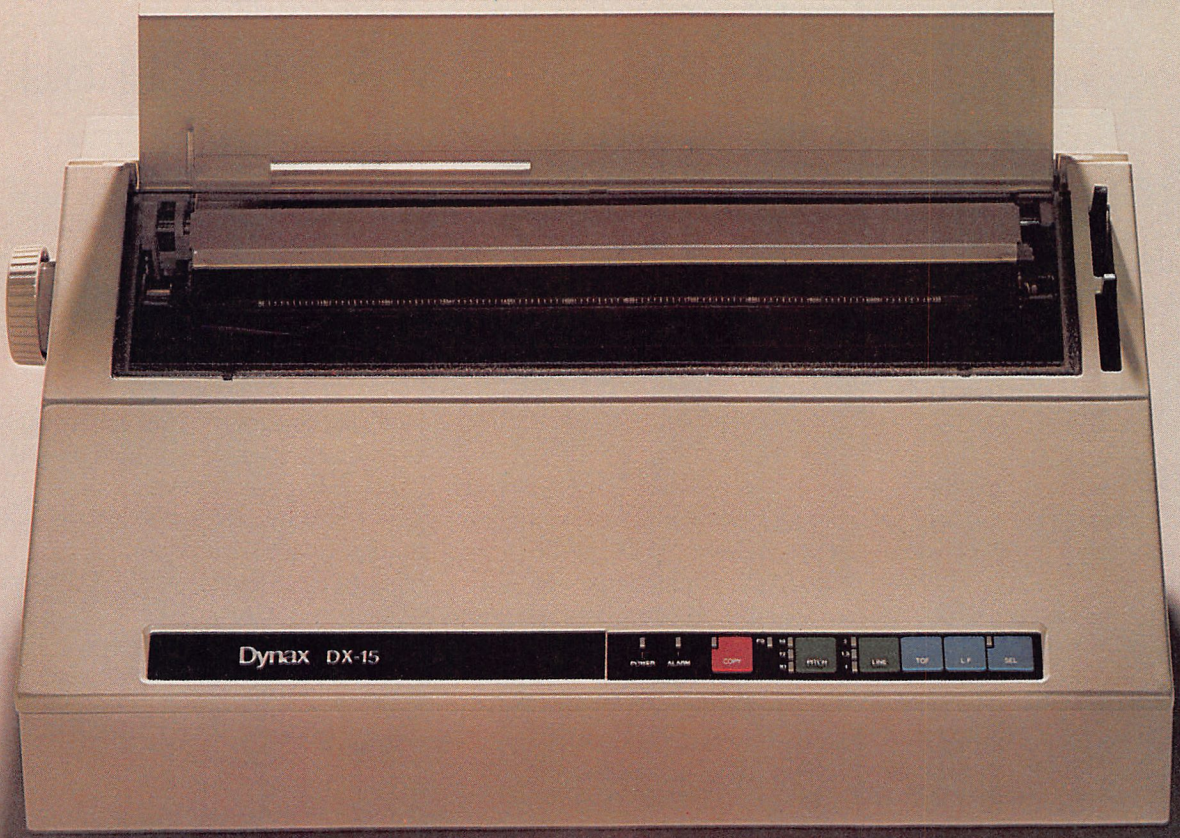
DYNAMITE



The Dynax DX-15 explodes into the eighties as the most advanced letter-quality printer on the market today. Complete with all the sophisticated features found in your costlier models, and offering such options as Key Board, Tractor Feed, and Auto Cut Sheet Feed, the DX-15 assures the user, whether it be for business, home or word processing applications, the ultimate in reliability and durability at a blow-away price.

The DX-15 won't blow your budget either, but it will blow the myth that a printer with all these advanced features has to be expensive. Visit or call your nearest dealer for full particulars and let us blow your mind at how inexpensive it is to put you behind the printer of the eighties, **the Dynax DX-15... It's Dynamite.**

Dynax

Dynax A DIVISION OF KANEMATSU-GOSHO (U.S.A.) INC. 5698 Bandini Blvd., Bell, California 90201

Inside Apple

Apple Computer Inc., 20525 Mariani Avenue, Cupertino, California 95014 Vol. 1 No. 2

For the authorized Apple dealer nearest you, call 800-538-9696 (800-662-9238 in California.)

Fruitful Connections.

There are more people in more places making more accessories and peripherals for Apples than for any other personal computer in the world.

Thanks to those people — in hundreds of independent companies — you can make the humblest 1978 Apple II turn tricks that are still on IBM's Wish List for 1984.

But now we're coming out with our very own line of peripherals and accessories for Apple® Personal Computers.

For two very good reasons.

First, compatibility. We've created a totally kluge-free family of products designed to take full advantage of all the advantages built into every Apple.

Second, service and support.

Now the same kindly dealer who keeps your Apple PC in the pink can do the same competent job for your Apple hard-disk and your Apple daisywheel printer.

So if you're looking to expand the capabilities of your Apple II or III, remember:

Now you can add Apples to Apples.

A joy to behold.

The new Apple Joystick II is the ultimate hand control device for the Apple II.

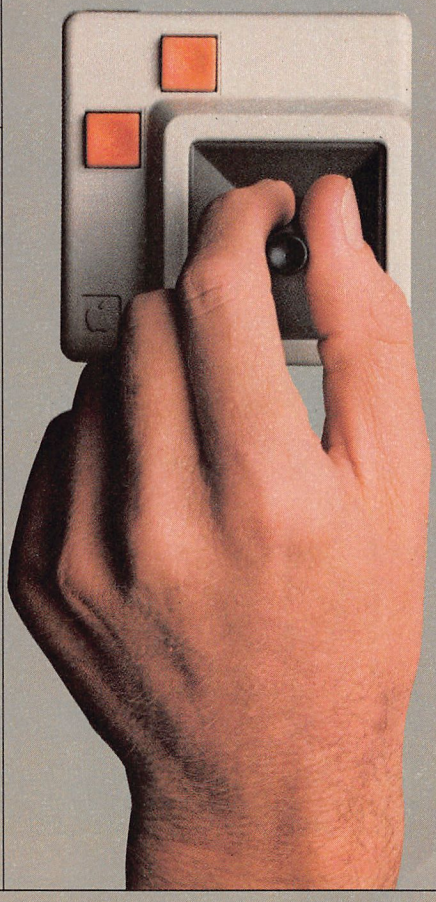
Why is it such a joy to use?

With two firing buttons, it's the first ambidextrous joystick — just as comfortable for lefties as righties.

Of course, it gives you 360° cursor control (not just 8-way like some game-oriented devices) and full X/Y coordinate control.

And the Joystick II contains high-quality components and switches tested to over 1,000,000 life cycles.

Which makes it a thing of beauty. And a joystick forever.



Gutenberg would be proud.

Old Faithful Silentype® has now been joined by New Faithfuls, the Apple Dot Matrix Printer and the Apple Letter Quality Printer.

So now, whatever your budget and your needs, you can hook your Apple to a printer that's specifically designed to take advantage of all the features built into your Apple. With no compromises.

The 7x9 Apple Dot Matrix Printer is redefining "correspondence quality" with exceptional legibility. With 144x160 dots per square inch, it can also create high resolution graphics.

The Apple Letter Quality Printer, which gets the words out about 33% faster than other daisywheel printers in its price range, also offers graphics capabilities. See your authorized Apple dealer for more information and demonstrations. Because, unfortunately, all the news fit to print simply doesn't fit.

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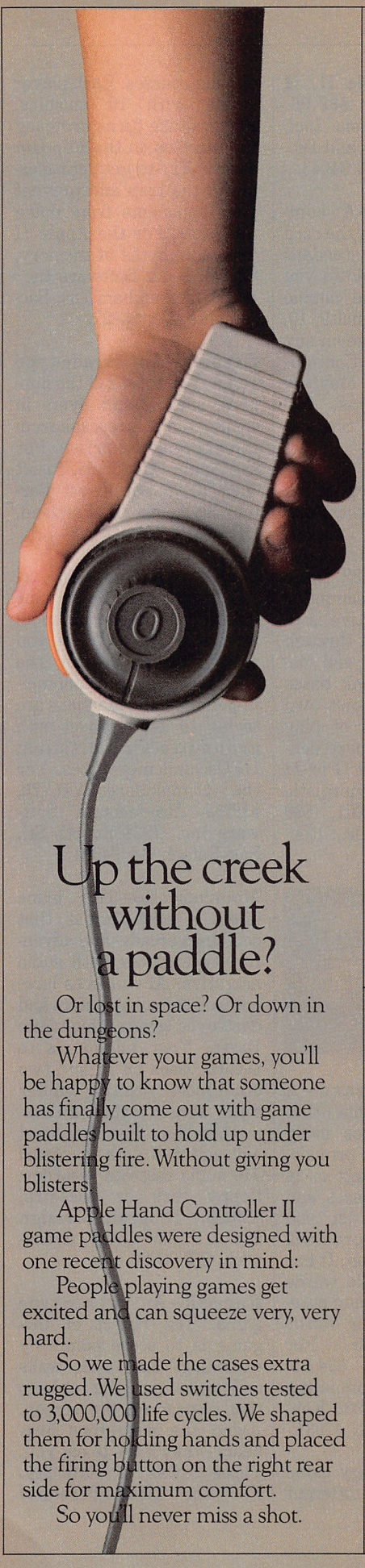


Up the creek without a paddle?

Or lost in space? Or down in the dungeons?

Whatever your games, you'll be happy to know that someone has finally come out with game paddles built to hold up under blistering fire. Without giving you blisters.

Apple Hand Controller II game paddles were designed with one recent discovery in mind:

People playing games get excited and can squeeze very, very hard.

So we made the cases extra rugged. We used switches tested to 3,000,000 life cycles. We shaped them for holding hands and placed the firing button on the right rear side for maximum comfort.

So you'll never miss a shot.

A storehouse of knowledge.

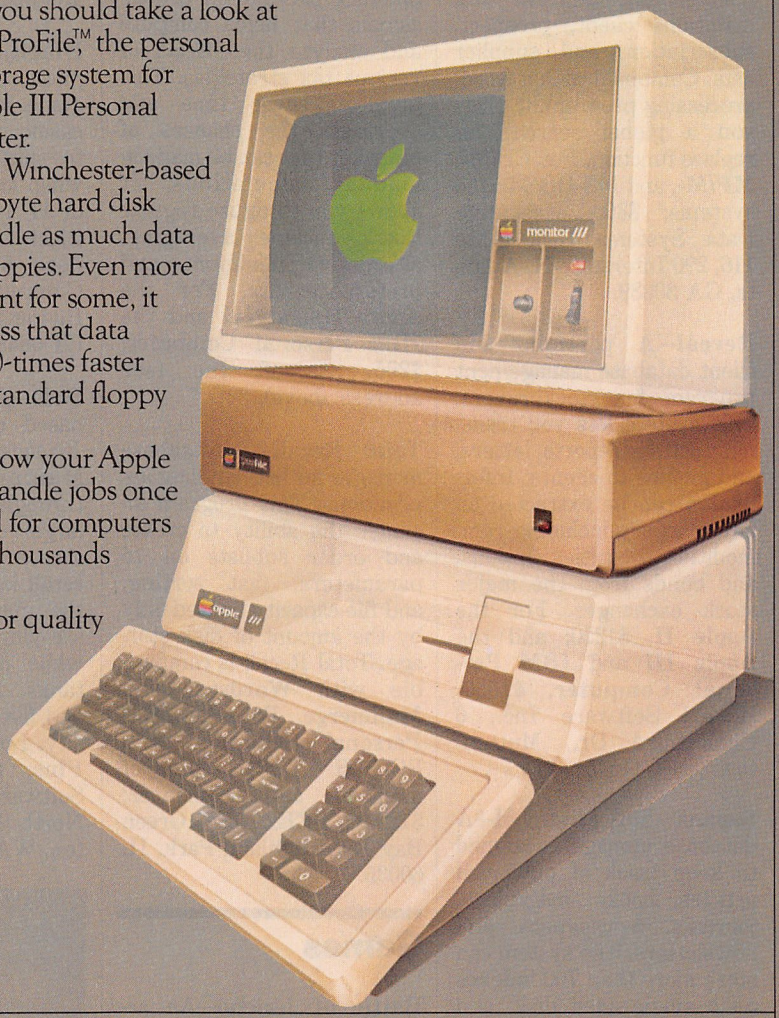
If you work with so much data or so many programs that you find yourself shuffling diskettes constantly, you should take a look at Apple's ProFile,™ the personal mass storage system for the Apple III Personal Computer.

This Winchester-based 5-megabyte hard disk can handle as much data as 35 floppies. Even more important for some, it can access that data about 10-times faster than a standard floppy drive.

So now your Apple III can handle jobs once reserved for computers costing thousands more.

As for quality and reliability, you need only store one word of wisdom:

Apple.



Launching pad for numeric data.

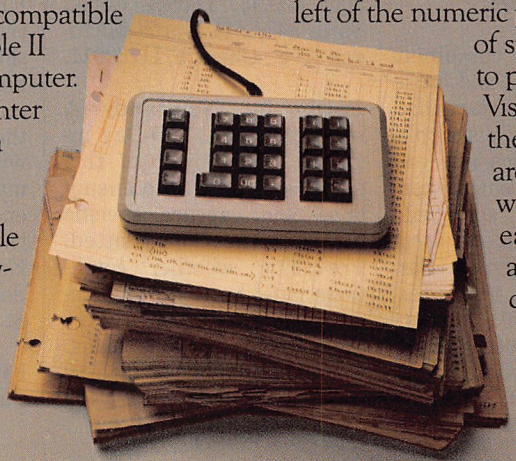
Good tidings for crunchers of numerous numbers:

Apple now offers a numeric keypad that's electronically and aesthetically compatible with the Apple II Personal Computer. So you can enter numeric data faster than ever before.

The Apple Numeric Keypad II has a standard calculator-style layout. Appropriate, because unlike some other keypads, it can actually function as a calculator.

The four function keys to the left of the numeric pad should be of special interest to people who use VisiCalc.® Because they let you zip around your work sheet more easily than ever, adding and deleting entries.

With one hand tied behind your back.



VisiCalc is a registered trademark of VisiCorp. Inc.

Circle 6 on inquiry card.

The Prospector—A sales-management database that maintains client, prospect, subscription, and supplier lists. Combined with a word-processing program, it gives you a global search and replace function. For **CP/M-, MP/M-,** and **MS-DOS-based** systems; $300. Executive Data Systems Inc., Suite 116, 290 Interstate N, Atlanta, GA 30339.

Reveal—A portfolio and client database management program for stockbrokers. This system lets you transmit portfolio reports, letters, and memos to clients. Information can be extracted on any category including commodities, securities, options, and bonds from the major stock exchanges. For the **Apple II**, $1250; and the **Apple III** and **IBM Personal Computer**, $1550. Reveal Software Inc., 6 Chelmsford Dr., Muttontown, NY 11545.

Sapana Soft Index I—A database manager designed to keep track of published articles, books, magazines, journals, newspapers, and newsletters. The system can store more than 700 indexes on a single-sided disk, and entries can be modified, added, or deleted at any time. For the **IBM Personal Computer** with 64K bytes of memory, PC-DOS, an 80-column display, and printer; $49.95. Sapana Micro Software, 1305 South Rouse, Pittsburg, KS 66762.

Stats Plus—A combined statistical analysis and database manager program that is compatible with Visicorp's **Visicalc**. Statistics are entered into the system and can then be sorted, searched, edited, reviewed and printed in the form of a graph. For the **Apple II** with 48K bytes of memory; $200. Human Systems Dynamics, Suite 107, 9249 Reseda Blvd., Northridge, CA 91324.

Tax Mini-Miser—A tax-planning package for professionals that helps compute and analyze the effects of various tax strategies. This program saves time and decreases the chances of mistakes that can be made in manual calculations. It allows you to figure regular taxes, income averaging, alternative minimum, and preference tax. For the **Apple II** and **III** and the **IBM Personal Computer**; $295. Starsoft Inc. (see address above).

Total Recall—A database manager for list-handling applications. This program includes the ability to create and order sublists on 15 parameters, fast sorting, and file capacity limited only by the amount of disk storage. Total Recall is compatible with **Wordstar** and **Mailmerge**. For the **IBM Personal Computer** with PC-DOS 1.1, 64K bytes of memory, and a printer; $129.95. PCEZ, 1867 Green Bay Rd., Highland Park, IL 60035.

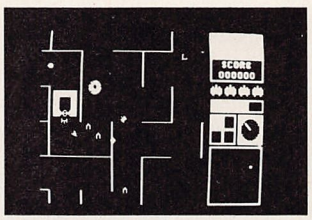
Games

Battle of Jericho—An arcade-type game in which the Biblical story of the fall of Jericho is reenacted. To bring the walls tumbling down, you must direct the "blasts" from the ram's horn in the right direction. For the **Apple II Plus** and **Atari 800**; $29.95. Davka Corp., Suite 843, 845 North Michigan Ave., Chicago, IL 60611.

Battle for Normandy—A recreation of the D-Day invasion. The object of this game is to penetrate enemy lines and capture specific towns in the time allotted. Prevailing weather conditions must be taken into account and play a large role in the outcome of your plans. For the Radio Shack **TRS-80 Models I** and **II, Atari 400** and **800**, and **Apple II, II Plus**, and **III**; $39.95. Strategic Simulations Inc., Suite 108, 465 Fairchild Dr., Mountain View, CA 94043.

Blackjack-MCS—A computerized version of the card game. It adheres to standard casino rules and allows you to split a pair and double when two cards equal 9, 10, or 11. It pays double on any Blackjack. For the **Commodore 64**; $15.95. Mayhew Computer Systems, 290 Buddington Rd., Shelton, CT 06484.

Bolo—An arcade-type game based on the *Dinochrome Brigade* by Keith Laumer. Manipulate your tank through a maze 132 times larger than your computer screen. Your objective is to scroll left and right through the maze seeking and destroying enemy tank bases while defending your own tanks. Nine levels of play and five levels of maze density. For the **Apple II** or **II Plus**; $34.95. Synergistic Software, Suite 201, 830 North Riverside Dr., Renton, WA 98055.



Crossword Wizard—A crossword puzzle helper that finds difficult words using the information you provide. Enter the known letters in the appropriate spaces and the program will let you know how many words will meet that description. It has the ability to handle words with 2 to 12 letters and automatically checks for words ending in the letter *s*. For the **Osborne 1**; $34.95. Eastern Indiana Computing Services, Suite 2, 202 Kehl St., Connersville, IN 47331.

Flip Out—A strategy game that features nine different playing courses. Each player starts with 10 marbles. Players take turns dropping the marbles on the Flip Out course. Try to get your marble in the trap and prevent your opponents from doing the same. For the **Apple II** with 48K bytes of memory; $29.95. Sirius Software Inc., 10364 Rockingham Dr., Sacramento, CA 95827.

Grapple—An arcade-type game. You must foil the hoppers, snerds, and flyers in their attempt to escape from the intergalactic prison. For the **Apple III**; $29.95. Insoft Inc., 10175 Southwest Barbur Blvd., #202B, Portland, OR 97219.

Martian Raider—An arcade-type game. Guide your intergalactic battleship in an attack on Mars. While you are trying to destroy the Martian cities and ammunition dumps, the Martians are trying to destroy you with ground-to-air missiles, UFOs, and meteorites. For the Commodore **VIC-20**; $19.95. Broderbund Software Inc., 1938 Fourth St., San Rafael, CA 94901.

Moonbase Io—This game offers a new format that combines arcade- and adventure-type games with audio narration. Alien forces have entered the solar system and destroyed several ships from Earth. Your mission is to secure bases on Io and two other moons orbiting Jupiter and attack the aliens' mother ship. For the **Atari 400** and **800** with an **Atari 410** audio cassette recorder; floppy disk or cassette, $29.95. Program Design Inc., 11 Idar Court, Greenwich, CT 06830.

Ramsak—An arcade-type game. The object of this game is to score points by exploding the brick walls and collecting the objects that appear on the screen. Avoid the dangerous bugbears—they'll try to eat you. Three levels of difficulty. For the **IBM Personal**

Computer; $29.95. Heigen Corp., POB 15163, San Francisco, CA 94115.

Sands of Egypt—An adventure game in which you explore the desert seeking objects that will lead you to a treasure. You must fight off the many dangers you encounter. Experimenting with the commands is part of the challenge. For the **TRS-80 Color Computer** with 16K bytes of memory, Extended Color BASIC, and a disk drive; $29.95. Radio Shack, 1800 One Tandy Center, Fort Worth, TX 76102.

Serpentine—An arcade-type game in which huge serpents have taken over the Earth. Having tamed some of the evil serpents, you ride them through the mazes in an attempt to destroy others. For the **Atari 400** and **800**; floppy disk or cassette, $34.95. Requires a joystick. Broderbund Software Inc. (see address above).

Shark Trap—An arcade-type game. Pirates have thrown you overboard into shark-infested waters. You must try to snare the sharks with your atomic net and, at the same time, avoid the increasing number of deadly octopi. For the Commodore **VIC-20**; $19.95. Broderbund Software Inc. (see address above).

Swamp Chomp—An arcade-type game situated in the land of Muckedoo. The object of the game is to get from your house to your feeding station in the 40 seconds allotted. To do so, you must cross a swamp filled with alligators and other creatures. Once you've eaten, you have 9 seconds to gobble up the swamp creatures for points and return home. For the **Atari 400** and **800** with 24K bytes of memory; floppy disk or cassette, $29.95. Program Design Inc. (see address above).

Wavy Navy—Your PT boat is being attacked by a squadron of enemy bombers and kamikaze pilots. You score points by shooting them down, but you lose the game if your boat is hit. For the **Apple II**; $34.95. Sirius Software Inc. (see address above).

Y-Wing II—The sea-giant Stormslayer has captured all life on Tazgard and enslaved them at the bottom of the sea. In your Y-wing fighter, you probe the underwater channels avoiding dreadful creatures in order to find and defeat Stormslayer. For the Heath/Zenith **H/Z-89, Z-90, Z-100, HS, H-19,** and **HDOS-** and **CP/M-based** systems; $21.50. Evryware, POB 60802, Sunnyvale, CA 94088.

Education

Alphabet Soup—A competitive spelling game for up to five players. The program presents a list of 5 to 14 letters. You then have up to 200 seconds to spell as many words as you can using the letters provided. The number of letters and time allotted depend on your level of skill. For the Radio Shack **TRS-80 Color Computer** with Extended BASIC; $14.95. Creative Technical Consultants, 16-8 Sangre de Cristo, POB 652, Cedar Crest, NM 87008.

The Bank Street Writer—An educational package intended for use in schools. It includes the word-processing program designed for children that is described under Home. This version includes three program disks, a tutorial program, student guide, and teacher's manual. For the **Apple II** and **II Plus**, $95; and the **Atari 400** and **800** with 48K bytes of memory and BASIC cartridge, $95. Scholastic Inc., 902 Sylvan Ave., En-

Computer Books For Beginners

New At Your Bookstore

Our books are available at most booksellers and computer stores everywhere around the world, including B. Dalton Bookseller, Waldenbooks, Crown Books, Coles and Gateway. We also cover TIMEX 1000/Sinclair; APPLE; Atari; TRS-80 Color and TDP-100; IBM P.C.; Casio, Sharp, and TRS-80 pocket computers; and TRS-80 Model I/III. If not in stock, ask your bookseller to order.

ARCsoft Publishers

Texas Instruments

101 Programming Tips & Tricks for the Texas Instruments TI-99/4A Home Computer, by Len Turner, learn-by-doing instructions, shortcuts, hints, secrets, includes 101 ready-to-run programs, 128 pages, ISBN 0-86668-025-X. **$8.95**

36 Texas Instruments TI-99/4A Programs for Home, School & Office, by Len Turner, practical type-and-run software for home, classroom and small-business office, 96 pages, ISBN 0-86668-024-1. **$8.95**

Texas Instruments Computer Program Writing Workbook, by Len Turner, handy supply of program-writing worksheets, graphics grids, BASIC instruction, for TI-99/4A, 96 pages, ISBN 0-86668-812-9. **$4.95**

Commodore VIC-20

34 VIC-20 Computer Programs for Home, School & Office, by Howard Adler, tested ready-to-type-and-run software for classroom, business, home, all new for VIC, Commodore 64, 96 pages, ISBN 0-86668-029-2. **$8.95**

101 Programming Tips & Tricks for the VIC-20, by Howard Adler, collection of practical efficient program-writing hints, secrets, techniques, shortcuts, easy-to-use instructions, includes 101 ready-to-run programs, 128 pages, ISBN 0-86668-030-6. **$8.95**

VIC-20 Computer Program Writing Workbook, by Howard Adler, useful collection of software-writing coding forms, graphics grids, BASIC instruction, 96 pages, ISBN 0-86668-811-0. **$4.95**

glewood Cliffs, NJ 07632.

Bible Baseball—A program that tests your knowledge of the Old Testament. Each time you correctly answer a question you move ahead in a simulated baseball game. Bible Baseball can be played against an opponent or the computer. For the **Apple II Plus** and the **Atari 800**; $25. Davka Corp., Suite 843, 845 North Michigan Ave., Chicago, IL 60611.

Flight Simulator—A program that simulates the flight of a single-engine Cessna 182. The package is designed for both experienced and novice pilots and will increase in difficulty as you master each skill level. The simulation takes into consideration such flight conditions as the time of day, cloud cover, season, wind shear forces, and carburetor icing. For the **IBM Personal Computer** with 64K bytes of memory, color/graphics card, and PC-DOS operating system; $49.95. Microsoft Corp., 10700 Northrup Way, Bellevue, WA 98004.

Microbe: The Anatomical Adventure—This program combines an adventure game with elements of medical science to teach you the human anatomy. A submarine and a four-member crew have been miniaturized and injected into a human body. Their mission is to locate and rid the body of disease and repair damage to the brain. Many factors must be taken into consideration including time, amount of air and fuel, attacking organisms, and more. There are three levels of difficulty: the first lets you use the program strictly as an adventure game; the second helps you learn facts about health care, anatomy, and medicine; and the third is for college-level science students, premedical students, and medical students. For the **Apple II**; $44.95. Synergistic Software, Suite 201, 830 North Riverside Dr., Renton, WA 98055.

Preschool Library—A collection of four programs designed to teach children shapes, letters, and numbers, while developing hand-eye coordination and listening skills. For the **Atari 400** and **800**; cassette, $59.95 (complete package). Individual cassette versions, $16.95. Individual disk versions, $23.95. Program Design Inc., 11 Idar Court, Greenwich, CT 06830.

The Presidents of the United States—A five-option program created to help you learn the names and dates of the 40 American presidents. For the **Apple II**; $40. PPG Programs, POB 2490, Santa Fe, NM 87501.

Spelling Can Be Fun—This program displays a word spelled in several different ways and asks you to identify and type the correct spelling. The program can be modified for any age level. For the **Apple II**; $40. PPG Programs (see address above).

Wordtrix—Working against the computer, you try to pick out as many words as you can from a grid of random letters. For the **IBM Personal Computer**; $34.95. Insoft Inc., 10175 Southwest Barbur Blvd., #202B, Portland, OR 97219.

Home

The Bank Street Writer—A word-processing system for children and adults developed by Bank Street College. Features include uppercase and lowercase text, search and replace, block move and remove, automatic centering and indent, inverse highlighting of text, word wrap, password protection, and print format. A school-oriented version is described under Education. For the **Apple II** and **II Plus** and the **Atari 400** and **800**; $69.95. Requires 48K bytes of memory. Broderbund Software Inc., 1938 Fourth St., San Rafael, CA 94901.

E-Z Tax—A menu-driven personal income tax preparation program that has the ability to prepare the 1040A, the 1040EZ, and more than 25 other IRS forms and schedules. For the **Apple II** and **II Plus, Atari 400** and **800, IBM Personal Computer**, and **CP/M-based** systems; $69.95. E-Z Tax, Suite 208, 2444 Moorpark Ave., San Jose, CA 95128.

Multisound Synthesizer—A program that allows you to use your computer as a musical instrument and white-sound synthesizer. Features include a five-octave range, multiple voices, and four programmable memories. Special effects include beat, vibrato, decay, automatic drum and rhythm routines, and UFO sounds. For the Commodore **VIC-20**; cassette, $19.95. Broderbund Software Inc. (see address above).

Languages

PCFORTH—An implementation of the FORTH language compiler. PCFORTH features special dump and printer functions and includes the standard fig-FORTH editor function. For the **IBM Personal Computer**; $59.95, with manual. Armadillo International Software, POB 7661, Austin, TX 78712.

Word Processing

Qwerty—An easy-to-learn word-processing program that features unlimited ruler usage, centering, underscore, boldface, subscript, superscript, double underscore, and strike-through abilities. The system also supplies online help when needed and comes with a tutorial workbook. For the **IBM Personal Computer** with PC-DOS and 64K bytes of memory; $325. Sixty-day trial plan. HFK Software, POB 150, Danbury, NH 03230.

Wordplus-PC—An easy-to-use word-processing program that features the ability to move entire paragraphs, global search and replace, automatic page numbering, underlining and boldfacing as you type, and merging name and address information from other programs. The system will also allow you to input new letters while printing others. For the **IBM Personal Computer**; $395. Professional Software, 51 Fremont St., Needham, MA 02194.

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The Micro-Mainframe War

Corporate battles erupt when micros encroach on mainframe turf

by A. Richard Immel

Brian Tickler's french toast has grown cold—colder than the fork he's been poking at it with—but the transplanted Britisher doesn't seem to notice. We're sitting in the Sugar Plum Restaurant in San Francisco, and french toast is far from his mind right now. Computers and computer software are the subjects that occupy his mind at the moment.

Brian Tickler is a computer consultant. He's worked for a lot of computer companies, big and small; he knows IBM the company and IBM the machine; he's worked for the pioneers in the small-computer industry; he's programmed for the government, the phone company, and insurance firms. He knows the good that can come from computing, and he knows the bad (he once whipped up a forecasting package that Equity Funding Corp. used, without his knowledge, to help set up bogus policies for its epic insurance fraud of the mid-1970s).

Since 1979 Tickler has been on his own, creating and selling custom accounting systems to large corporations. Depending on how extensive they are, the systems sell for anywhere from $50,000 to $150,000. Tickler has also been championing the microcomputer as the ultimate business tool. Computers are his life. "This isn't just a job," his wife, Carmel, leans over to whisper. "He eats, sleeps, and breathes computers."

I should explain that Brian Tickler is also known as the Software Kid. It's a moniker he was christened with a couple of years ago in a Wall Street Journal *story called "The Software Kid Inveighs Against the Witch Doctors." The "witch doctors" are the keepers of the holy data-processing department, and he had some pretty harsh things to say about them. He still does.*

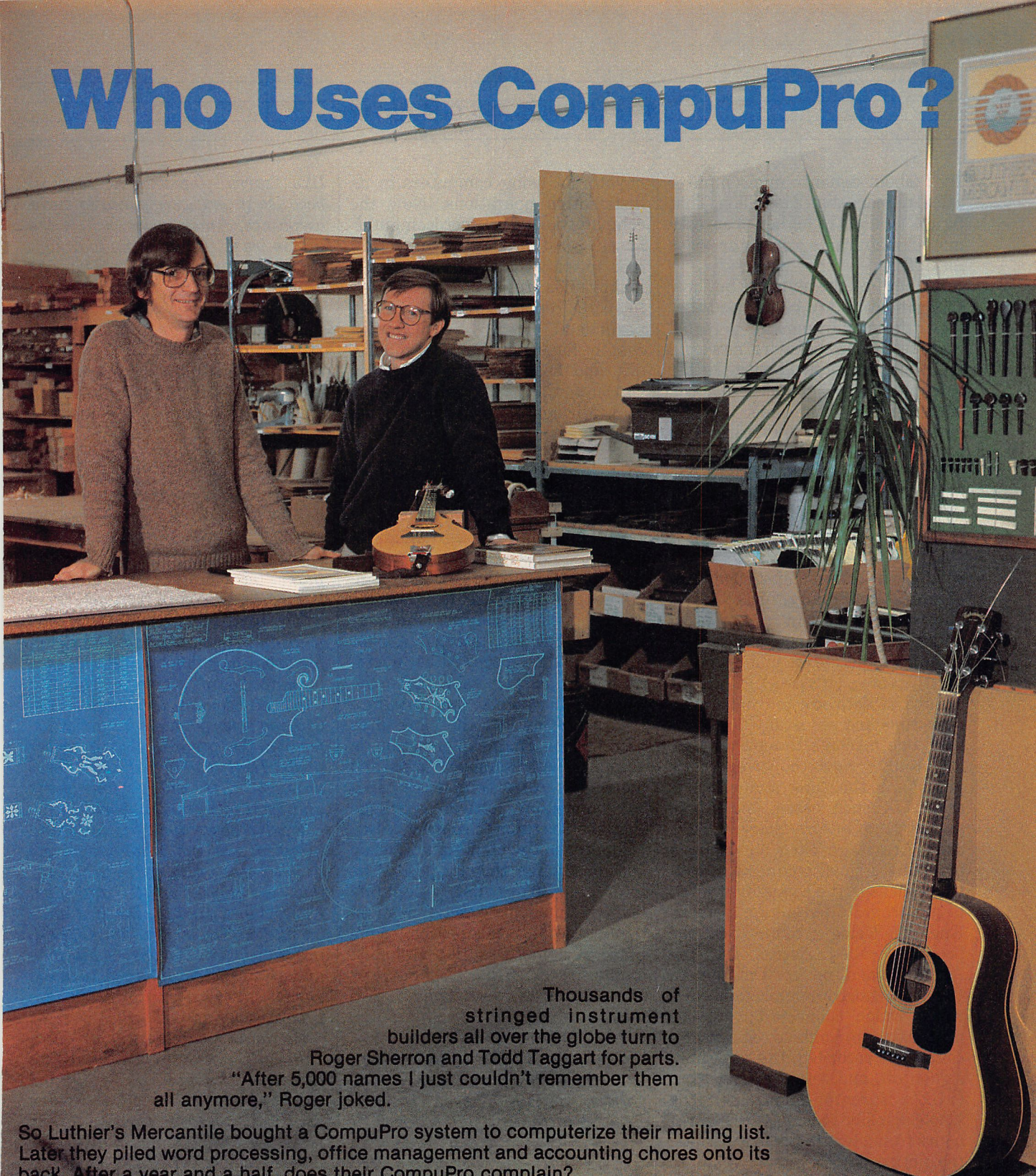
Illustration by Jean Tuttle

Corporate Micros

Now that IBM has legitimized microcomputers with its popular IBM Personal Computer and *Time* magazine has blessed them with its machine-of-the-year issue, maybe it's time to cut through all the posturing about micro millennia and get down to what these little hummers are actually doing in Corporate America. You might be surprised.

Microcomputers are nibbling at those hallowed mainframes locked away behind layers of secrecy, those machines that have made IBM the eighth largest company in America. Indeed, the trend is starting to build: microcomputers are gaining corporate ground. One market-research firm, International Data Corp., recently forecast that by 1986 annual sales of microcomputers will have risen from slightly more than $4 billion in

Who Uses CompuPro?



Thousands of stringed instrument builders all over the globe turn to Roger Sherron and Todd Taggart for parts. "After 5,000 names I just couldn't remember them all anymore," Roger joked.

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Roger added, "We had a service contract and we didn't have to make a single call. We've never even needed to kick it."

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1982 (about equal to minicomputer sales) to more than $14 billion. That figure is slightly higher than estimated mainframe computer sales for 1986.

It's not just the numbers but how the computers are being used that threatens mainframes. As personal computers become more powerful and programmers devise better software, these small machines will encroach on mainframe turf by siphoning off data and using it in ways that mainframes can't.

The examples that follow indicate how and why corporations are using microcomputers to communicate with their mainframes.

•C-I-L, a billion-dollar Canadian chemical company, has found Apple IIIs useful in a number of situations for transferring small amounts of data from mainframe to mainframe. Normally, large chunks of data are put onto magnetic tape and physically delivered from one machine to another. For 300 or 400 records, however, that's not worth the time and effort it takes. In such cases, the Apple serves as an intermediary. C-I-L's John Armytage cites an example involving a small engineering software package the company wanted to get from its parent company in England. Using a communications program called Access III, the Apple signed on to Datapak, a Canadian telecommunications network, which connected it to the mainframe in England. The microcomputer recorded the program, signed off, and retransmitted it to C-I-L's Toronto mainframe. The whole transfer took only a couple of hours from start to finish instead of the entire day it usually takes to make a tape and the additional two days it takes to send that across the Atlantic.

•Foremost-McKesson Inc., a $4.5-billion food, drug, and liquor marketing giant, has been a major innovator in using computers in its distribution operations. Now the company is using microcomputer-based word processors and IBM PCs to extract data from its IBM mainframes to prepare monthly financial reports, support an experimental executive information system for senior financial managers, and keep its data centers in Oakland, California, and Kalamazoo, Michigan, electronically updated.

•Bank of America, the nation's largest commercial bank, is one of a dozen big banks that are plugging personal computers into their internal data-distribution systems to gain access to the bank's huge transaction database for financial modeling and analysis. Bank of America has also started a pilot program that uses Altos microcomputers as part of a cash-management package to let corporate treasurers tap into the bank after hours for overnight information on account balances, money rates, and more. The Altos computers use a communication software package that enables them to connect with a computer in the bank that is set up specifically for this purpose. The microcomputers use telephone lines and modems exactly as an individual would use a personal computer at home to call up an online database service like The Source or Dow Jones News/Retrieval Service.

The Software Kid is not really a kid anymore. He's in his mid-forties, and he's been knocked around in the computer wars. He has a voice like a drill instructor and an opinion on everything. He's big—6 feet 5 inches—but he's a little soft around the edges, like a lot of guys who work inside too much.

The Kid got a rude start in computing. It was back in '59, before he even knew what software was. He was an aeronautical engineer fresh out of school and ready to take on the world. He came to the U.S. from Surrey, England (it sounds like "sorry" the way he says it) because if you were going to build airplanes, America was where the action was. "I was going to design the best plane that ever flew," he says. But then Uncle Sam gummed up the works: Tickler found out he was going to have to register for the draft. "I decided an aeronautical engineer wasn't going to make it digging ditches in the Army," he says. He joined the Air Force.

After acing his aptitude tests at Lackland Air Force Base, Tickler's sergeant told him he was going to computer-programming school. "He told the class, 'you're going to be programming this computer in six weeks.' We didn't know what a computer was."

The machine was an IBM 650 with an enormous magnetic drum for external memory and 2K bytes of main-board memory. The Kid learned assembly language on the 650 and later got a medal for transferring the programs to a newer model IBM 7040 that the Air Force brought in. He did his four years and went out into the world.

Tickler does all of his programming in assembly language. He writes lean, mean code—programs that are tight, small, and fast. Operating systems? The Kid spits on them. Those are for COBOL programmers. He writes his own operating system if he really needs one. It's a luxury only the custom programmer can afford.

He doesn't care much for IBM, either. It's not that IBM is bad, it's just that the machines—and the company—aren't as good as they once were, he says. The Kid thinks IBM has sacrificed quality for market share. He believes that's why Gene Amdahl left and built a better mainframe computer to compete with IBM (Amdahl was IBM's top computer designer in the '60s). You can see it in the IBM PC, too, he adds. It's got an odd keyboard and wobbly circuit boards.

But what the Kid really doesn't like about IBM is the way it made

A. Richard Immel, a contributing editor to *Popular Computing*, is based in Northern California.

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TO SQUIRAL :ANGLE :DISTANCE
 IF :DISTANCE > 200 THEN STOP
 FORWARD :DISTANCE
 RIGHT :ANGLE
 SQUIRAL :ANGLE :DISTANCE + 3
END
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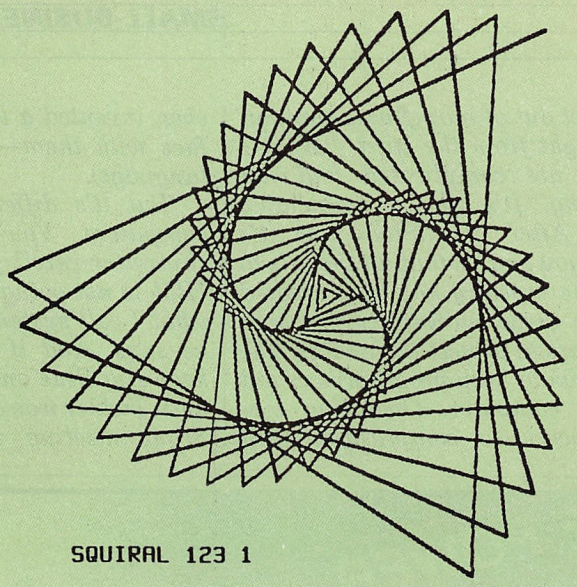

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a secret out of mainframe computing, right from the start. "What I do is not complicated and not amazing. It's like a magician's trick. After you know how it's done, you say 'Is that all there is to it?' The mystery has been created by the large manufacturers over the years to protect their sales. The idea was to keep programmers out of the computer. Operating systems were so complicated IBM even invented a language to interface with them—JCL (job control language).

"But it's different with microcomputers. You're dealing with computer-intelligent customers. IBM is not going to get away with what I call systems shenanigans," he says. And if no one else will keep Big Blue on its toes, the kids will. Tickler was delighted at a Boy Scout meeting when the scoutmaster announced a forthcoming session in computer programming. "Oh boy," said a scout, "can we learn assembly language?" "Assembly language!" the Kid roars. "These kids don't want to fool around with BASIC, they want to learn assembly language and get inside the machine!"

Micro to Mainframe

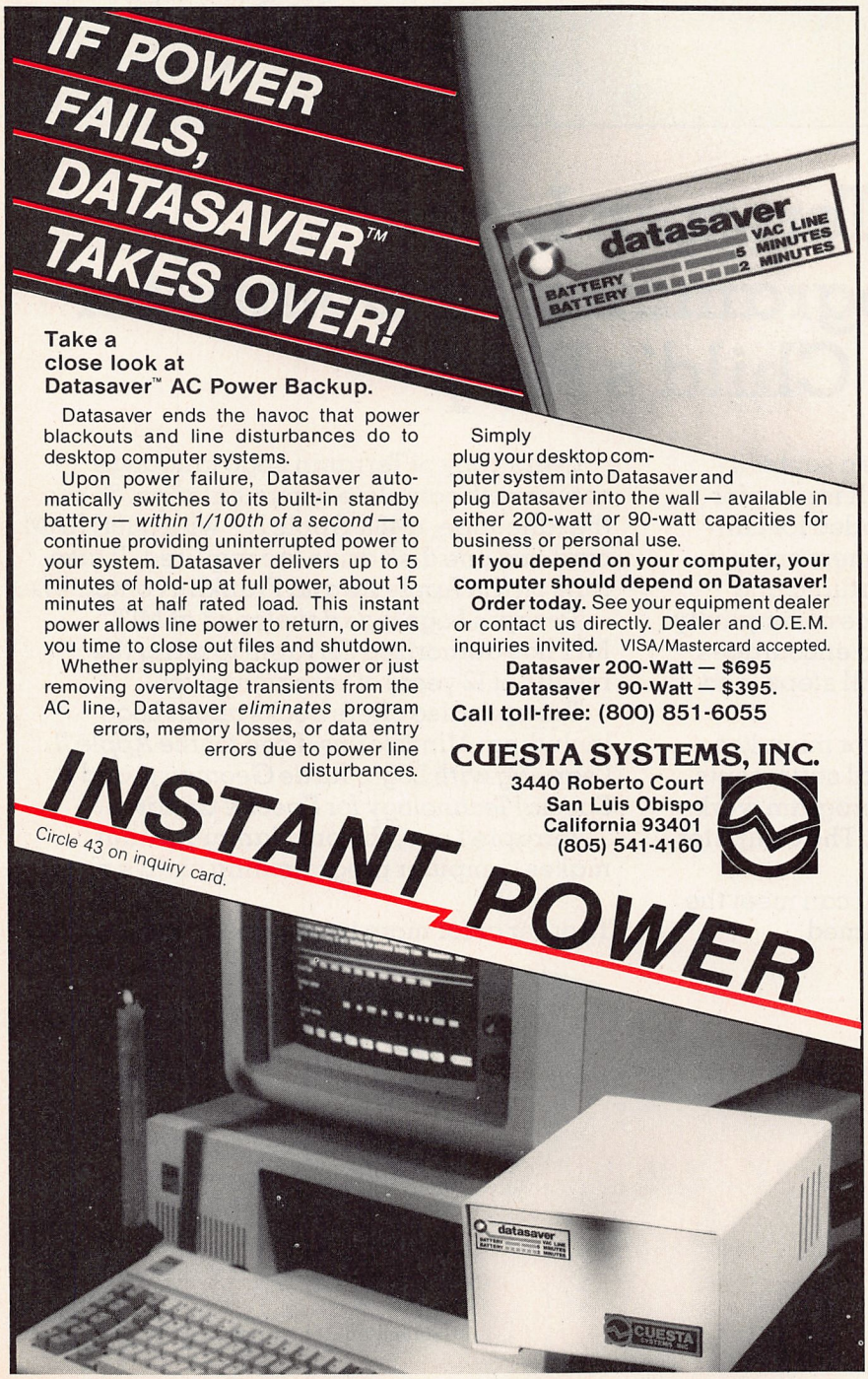
Suppose you do bring your Apple or your IBM or your TRS-80 or your Sinclair into the office and you want to tap into your company's mainframe to pull some numbers to run on Visicalc. How do you do it? Do you just pick up the phone and dial your computer's number? Actually, in many cases that's basically what you do.

Computers of any size talk to each other via either synchronous or asynchronous communication. Synchronous communication is very fast—up to millions of bits of information per second pass from mainframe to mainframe. This method also requires complicated hardware and software interfaces for error correction and to make sure both ends of the connection know when to transmit and when to receive.

All personal computers can send data asynchronously. Computer professionals call this "casual" communication because it's less reliable than synchronous communication and relatively slow (generally 300 to 1200 bits per second on phone lines).

Because they're so fast, mainframes generally require a device to buffer communications between them and the outside world. This may be either another mainframe computer or a minicomputer programmed as a timesharing system, or it may be a communications controller into which various terminals can be plugged.

The basis for most microcomputer-to-mainframe communication is some kind of hardware and software combination that makes the microcomputer emulate an existing terminal. Then the mainframe will



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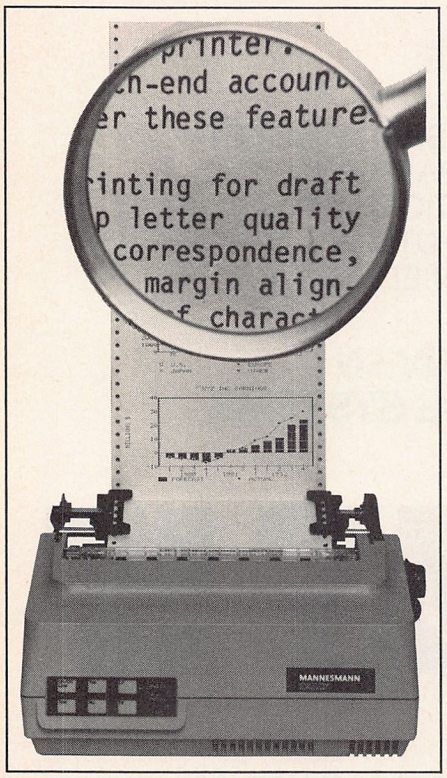

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send and receive whatever it would have sent to and received from its own terminal. The practical difference, of course, is that the personal computer can manipulate the data it gets because, unlike an ordinary "dumb" terminal that can only send, receive, and display characters on its screen, the personal computer has its own programs to use. In effect, the microcomputer becomes an "intelligent" terminal.

The controlling program might simply record incoming data on a disk for use at a later time (a *data capture* program) or it might be a more sophisticated spreadsheet program like Visicalc or Supercalc or whatever Visi clone runs on your particular machine. The cost for this kind of software ranges from $50 or $60 up to several hundred dollars.

Some microcomputers can also be converted to communicate synchronously, which means they emulate a particular synchronous mainframe terminal. IBM recently offered a hardware and software package for its Personal Computer that emulates an IBM 3270 communications controller. Apple Computer Inc. is offering a 3270 emulation package for Apple IIs and IIIs. The cost for this type of adapter ranges from $500 to $1000 per terminal. Several other serious business machines already have this feature built-in: the Fortune 32:16 and the Grid Compass are two examples. Most dedicated word processors also have this capability.

A more elaborate alternative to converting your system to communicate synchronously involves networking. Some local networks enable different makes of computers to communicate with each other as well as with a mainframe.

Fear and Loathing in DP

Hooking up your personal computer to a mainframe is only the first step. It's what comes afterward that has a lot of people worried. Software consultant David Ferris is one who sees a lot of misery growing out of managers tapping into mainframe data. His creeping-encroachment scenario goes something like this:

"They start out by bringing in spreadsheets; then it's graphics packages. Then they say, 'Hey, the data-processing (DP) department has developed these juicy applications; I want to get into that.' " Ferris says mainframe spreadsheets—financial models that are much more sophisticated than Visicalc-type spreadsheets—are starting to catch the eye of bright young financial managers with personal computers. The problem, he says, is that getting back and forth between the mainframe spreadsheet and the manager's desktop computer requires substantial programming on the part of the data-processing department.

"There are going to be complicated problems that will have to be solved by in-house data-processing staffs," Ferris says. It won't be easy, though, he says, because "your average data-processing department doesn't know very much about micros. The average department isn't well informed." The bottom line, as he sees it, is painful solutions, delays, and frustration—all of the things personal computers were supposed to eliminate.

George Hagen agrees that data-processing departments must readjust to the increasing use of microcomputers, but he thinks Ferris may be overstating the problem. Hagen has a unique perspective on the industry: before retiring as chief executive of the Toronto-based Reichhold Ltd., a major Canadian resin manufacturer, Hagen pioneered the use of microcomputers in his company. Now he frequently lectures executives on the advantages of putting microcomputers on managers' desks. He's also connected with a small company called Vertical Data Systems, which offers an inexpensive microcomputer conversion that enables electronic typewriters

to transfer blocks of data to and from mainframe computers over the phone line.

"The argument systems people are trying to make is that if they let microcomputers proliferate, they'll be faced with 100 different systems. I don't think it's valid," he says. "In most cases a manager who wants to use a microcomputer knows exactly what he wants to do with it. He probably isn't ever going to ask his data-processing department to do anything for him."

Hagen does agree, however, that personal computers have created fear and loathing in the data-processing community. Speaking at a conference of systems managers last year, he gave his standard pep talk on microcomputers and urged the data processors to "get aboard" the microcomputer bandwagon. But, he says, only 25 percent of those attending had any kind of program to introduce microcomputers in their companies—the rest were still afraid of losing power. "They want to hold on to their empires," he says.

The waitress clears away the Kid's icy, picked-over french toast and refills our empty coffee cups. She's starting to eye us as if we drifted in from Wino Park, so we order lunch. The Kid gets a plateful of club sandwiches cut in little triangles. He nibbles on the points of a couple of the triangles, brushes a shock of brown hair from his forehead, and explains the corporate microcomputer problem.

"There are three groups in a corporation that are concerned with personal computers," he starts out. "One, there's the data systems group; they regard personal computers as an extreme threat to their empire and to their budget. Two, there's the user who knows what he wants to do with data and knows intuitively that Apples (or whatever) can do it for him, but he can't make the bridge with the systems group. Three, there are the people in top management; they know what can be done but can't get the

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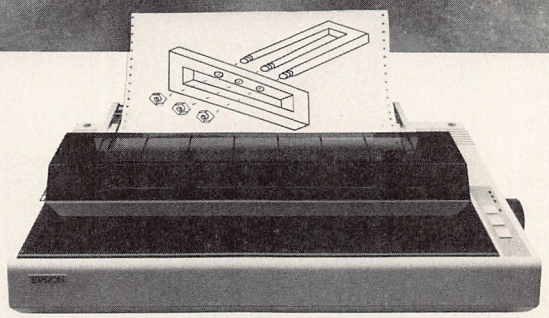

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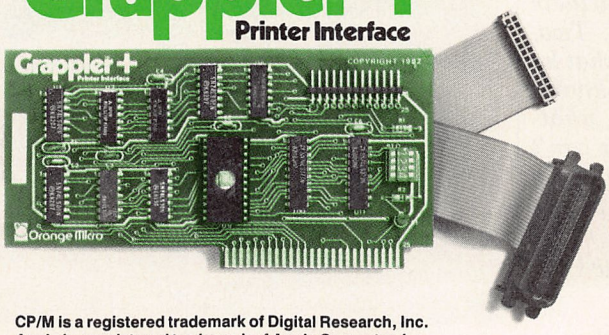

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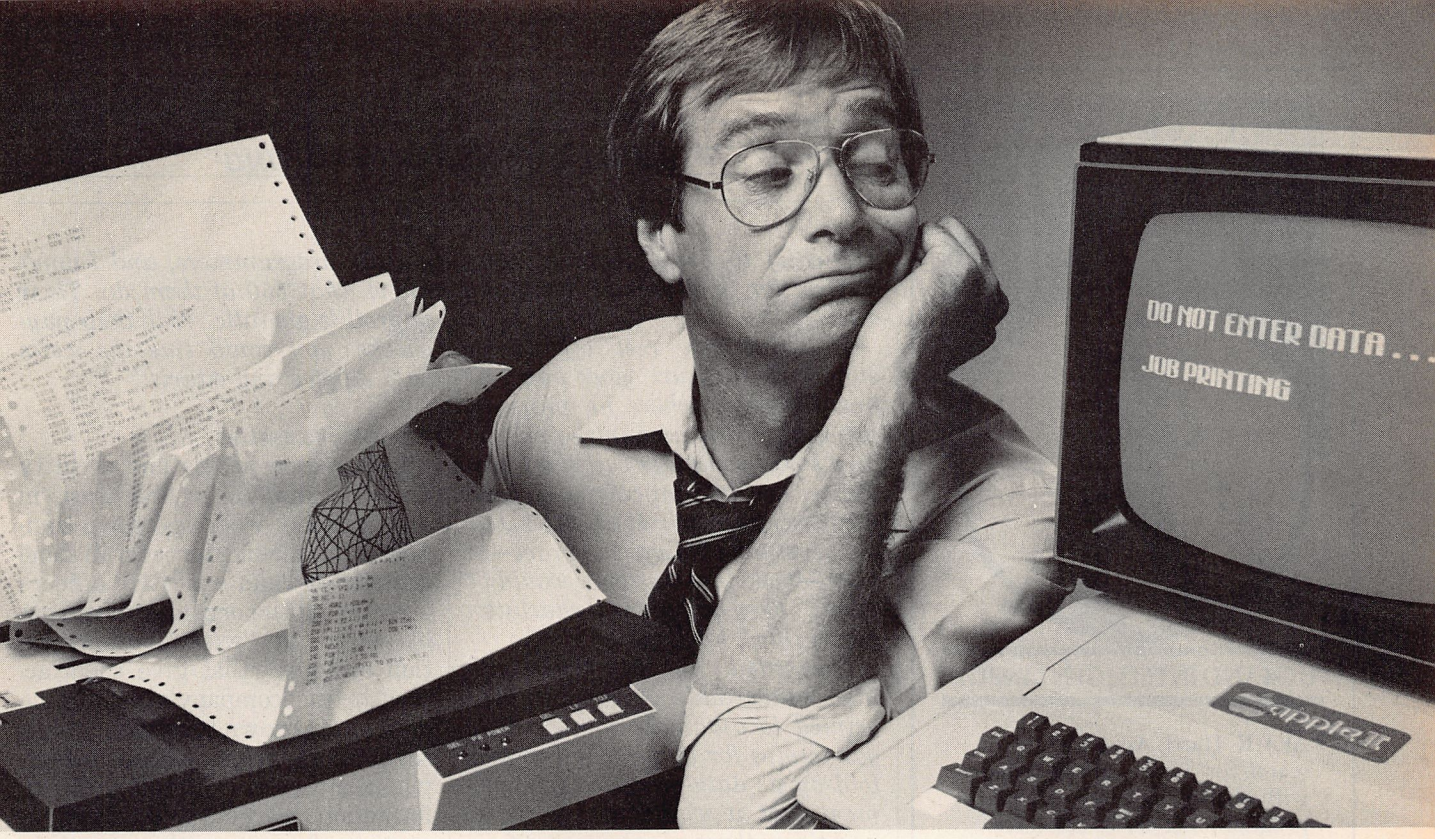

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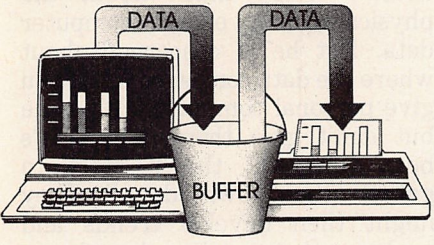

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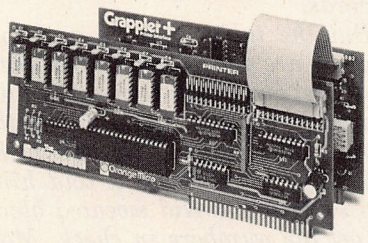

and economical buffering of most popular printer interfaces, including the Grappler + ™ interface, Epson interface, and Apple printer interface. Thirty seconds and a single hook-up are all you need to end the printer waiting game forever.

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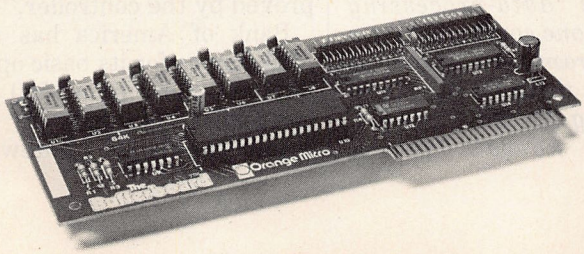

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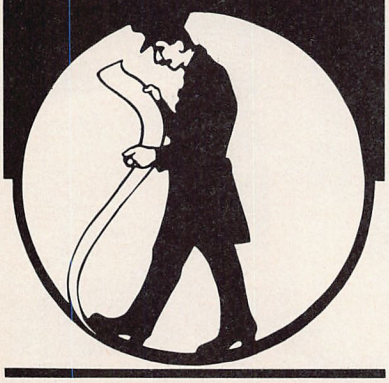

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DP chief to okay personal computers for widespread company use."

The Kid can reel off horror stories that'll curl your hair. At one company where he proposed bringing in his accounting system on a small computer called a Four-Phase, the data-processing department went berserk. It spent $50,000 on a study trying to prove—in vain—that the system wouldn't work. "They called me a charlatan and a liar," he says.

That wasn't his only brush with the Neanderthals. A company that wanted to automate some remote gas pumps for its vehicle fleet was told by its data-processing department that it would cost $500,000 and tie up three programmers for a year to do it. The Kid brought in three Atari 800s and a Micro-peripheral modem; the whole project cost only $12,000, and he set it up in two days.

He tells of an employee who sneaked in an Apple computer and called it something else on his expense voucher because the data-processing department wouldn't okay purchases of personal computers. He was fired for falsifying records.

But the tales of loose and lost money are the really hairy ones. The first run of his commercial accounting program went tilt to the tune of $76 million. No sweat, the company purchasing it told him. No sweat? The Kid sweated blood to get the numbers in check. Most of it came from sloppiness in the company's own bookkeeping before it even got into the Kid's system: totals that didn't jibe with the documents they came from. By the time Tickler whittled the figures down to $22 million, the company called him off; close enough, they said.

Even after he installed his accounting system and got it up and working, the data-processing department in one company kept a couple of programmers on the job to do the same thing on the mainframe. Padding like that, he says, is a corporate scandal. "They've got 400 programmers, and I don't know what 350 of them do. Their payroll is gigantic. With their paychecks, you could line the walls with Apples and Ataris."

The Micro Issues

Information access and security are also potential trouble areas in any company where personal computers are making inroads. In some companies, chief executive officers are rocking the organizational boat by setting up "executive information systems" that give them access to the company's mainframe data on their own terminals or personal computers. Senior managers, who are used to controlling the information that gets to the chief executive, frown on that practice. Still, it has positive results; it loosens up the organization and opens up communications.

But there's a dark side, too. Many problems would have been resolved before they got to the chief executive. By involving himself in details that normally don't concern him, the chief executive disrupts the normal and probably desirable management fabric of the company. So far there's no indication that companies with computer-wielding chief executives fare any better than the other kind.

At Foremost-McKesson, office-systems manager Charlie Hoerner doesn't worry much about the physical security of microcomputer data. But he is concerned about where the data comes from. "If you give personal computers to people but don't give them data that's been 'blessed,' they'll start to gather their own data." They might then develop trends and analyses that are based on incorrect inputs. In the financial area, for example, "I think we'll need to provide a database that's been approved by the controller," he says.

Bank of America has some 20 mainframes for its basic operations data and more than 1500 personal computers. It uses an Amdahl mainframe as a "gateway" be-

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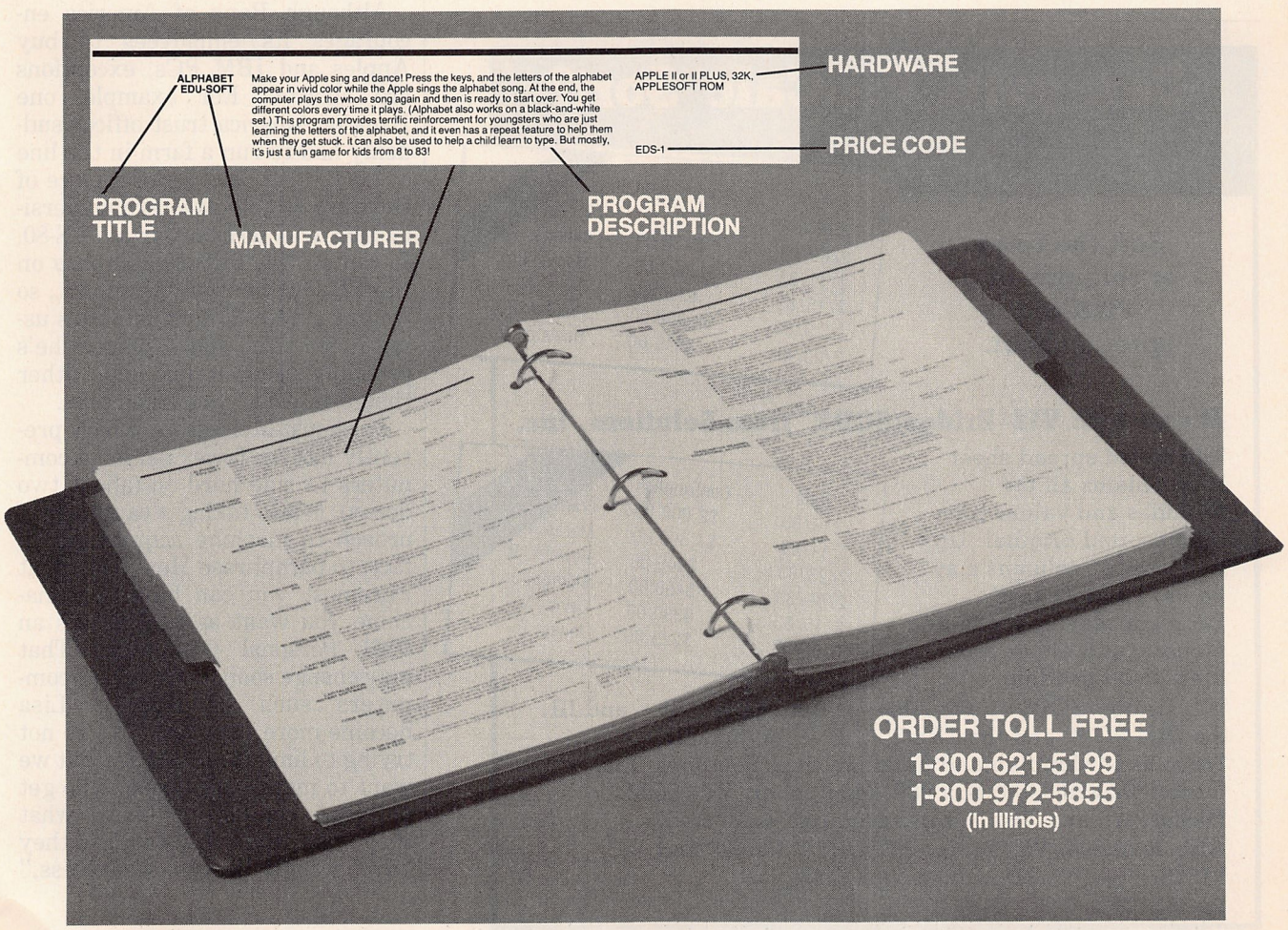

tween its operational database and the personal computers. The Amdahl is set up to communicate with terminals or personal computers as a timesharing system.

Data Ownership

All the data available on the Amdahl mainframe is tightly controlled. "Our mainframe databases are very much transaction-oriented," says Fred Schurkes, head of the bank's personal computer division. By that he means they're designed to handle day-to-day teller transactions and electronic banking, such as the company's Versateller automatic teller machines (ATM). "They're not built to handle personal computers. So what we do is run extracts from large databases when they're not very busy—in the middle of the night or the middle of the day, depending on the kind of data you're talking about."

Like many large corporations, Bank of America uses the data "ownership" concept and the intermediary computer to control access to its main data banks. "All data has an owner," says Schurkes, and it follows that anyone who wants to use that data must get permission from its owner. If, for example, a financial analyst in the cashier's division wants to do a study of time-deposit maturities, he or she needs access to the time-deposit database. The analyst would send a request to the California division explaining what data is needed and why. After the request is approved (which might take two weeks), the data itself would be taken off the mainframe and loaded into the Amdahl, where the personal computer, acting as a terminal, can get access to it.

With minor exceptions, Bank of America supports only Apple IIs and IIIs and IBM Personal Computers, but it is currently reviewing this policy. "Our concern is interconnectability," Schurkes says, but he adds that the bank wants to remain flexible for now because "we still don't know what kind of access people need to corporate files from remote stations."

Right now only microcomputers of the same brand can communicate directly with each other. In other words, if you have an IBM Personal Computer and you want to transfer data or send a note to an Apple, you have to use an in-house timesharing system as an electronic mail drop and transfer the data through it. "If it turns out that it's important to communicate at an applications level across wide areas of the corporation—which may happen—then we'll need to standardize equipment," Schurkes says.

Running a Farm

Although Bank of America encourages its employees to buy Apples and IBM PCs, exceptions are allowed. For example, one Bank of America trust officer suddenly had to run a farm in the line of duty. "He discovered a piece of software at a midwestern university that was written for a TRS-80. It ran on the TRS-80 and *only* on the TRS-80; he really wanted it, so we got a TRS-80 for him. He's using it for that, and I suspect he's probably using it for some other things as well," Schurkes says.

Foremost-McKesson, which presently has far fewer personal computers to ride herd on (about two dozen), is also taking a cautious approach to machine acquisition. In fact, to paraphrase Henry Ford, at Foremost you can have any machine you want as long as it's an IBM Personal Computer. (That may change soon, however, as computers such as Apple's Lisa become more popular.) "We're not trying to limit it arbitrarily, but we want to make sure people who get personal computers know what they want to do with them so they have a high degree of success,"

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Charlie Hoerner says.

There's still plenty of room for experimentation, of course, and Hoerner is all in favor of it. In his view even the failures are a step forward. "I believe in natural selection, in evolution, in survival of the fittest," he says. Any system that remains static will die, he adds, even though when you decide to introduce change in a system you don't really know what the effects will be.

"Personal-computer implementation has the possibility of going wrong, and I don't doubt we're going to see some phenomenal failures. For example, some companies might make it so hard to proceed through normal channels that out of desperation users will try end runs. On the other hand, some will be very successful. There might develop a new breed of manager—one who's data savvy, plugged into sources of information others don't have," Hoerner adds. "I'm not sure there's any way to avoid the failures, and I'm not sure you want to prevent them from happening. But you do want to cull the losers—and let the winners win."

The Kid loves Ataris. They're solid inside, they're easy to use, and their graphics make them potentially terrific word processors, he says. In fact, he's designing a business system based on the Atari 800.

The Kid has been expounding on mainframes—dinosaurs, he calls them. "You don't need them anymore for accounts payable and things like that. You could do the same thing with Apples and Ataris. Use the same number as you have terminals, tie them together with Omninet or something like that. With the old IBMs we used to have 16K bytes of memory and tape drives; what are we doing today that we didn't do then? It gets down to pretty small potatoes. You don't need a mainframe anymore."

Tickler also has some views on 16-bit versus 8-bit microcomputers. "For most users in companies, the difference is absolutely meaningless. You need 16-bit microcomputers only if you want high-resolution displays for computer-aided design or manufacturing. Besides, it doesn't matter if you have 8 bits or 16 bits or 256 bits if you don't have a good file-management system." That's a database manager he's talking about, and there aren't any decent ones, he says, except the one he's working on.

It won't be long, though, until all of this comes together. Tickler is working right now on a microcomputer-based business system that will satisfy even him. The whole works—computer, software, disk drive, video display—will sell for about $2000. The computer is an Atari 800.

An Atari 800? A game machine? Yes. The Kid loves Ataris. They're solid inside, they're easy to use, and their graphics make them potentially terrific word processors—better than the Apple II, he says. Atari scrapped $2 million worth of business hardware development a couple of years ago when it decided to go for games and the home market. Does the Software Kid know something Atari doesn't? Maybe. But so far he hasn't found anyone who will take his Atari project seriously.

We've been talking quite a while, and the waitress is getting fidgety; it's time for her to go off shift. We both reach for the check and grapple clumsily for the right to be small spenders. The Kid is surprisingly strong in the fingers. □

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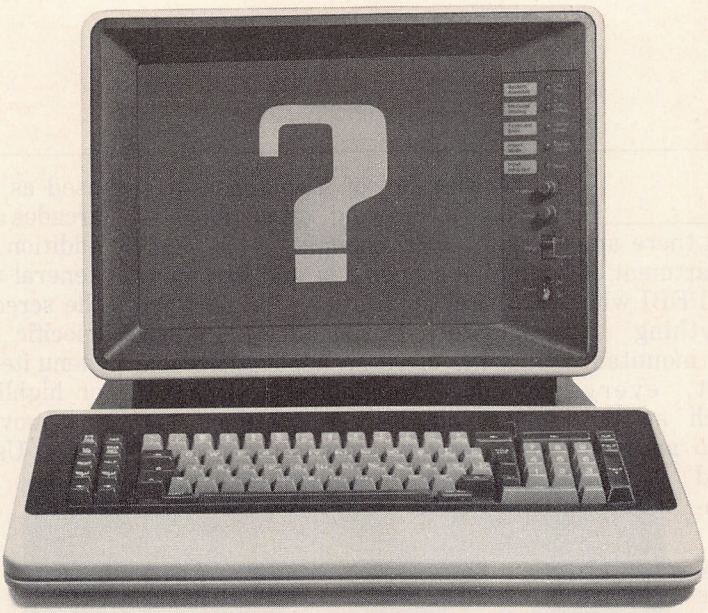

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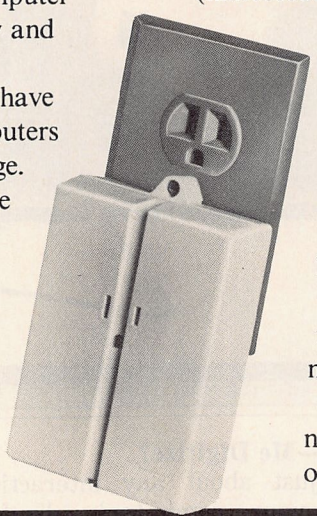

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Joysticks and Graphics Tablets

Devices that transfer visual data into your computer

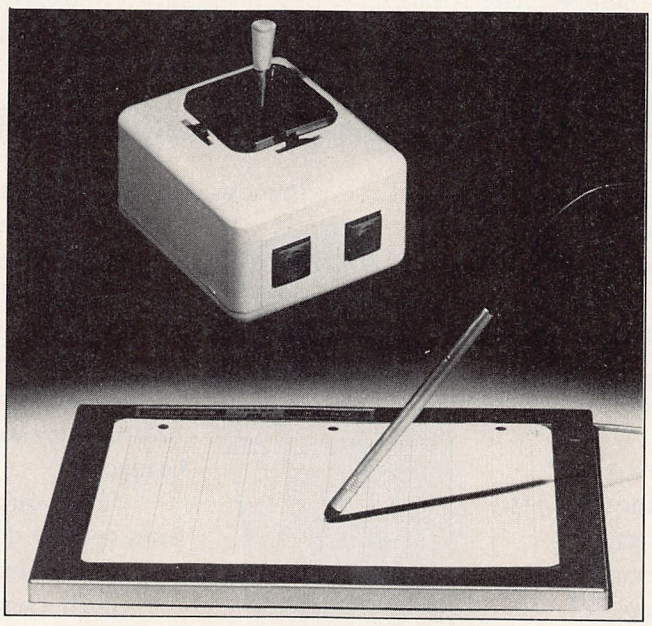
by William Barden Jr.

Don't look now but there are people in the Department of Defense, CIA, and FBI who are converting everything to digital values—every mountain range, every desert, every "cultural" feature, such as the Sears Tower in Chicago and the Jablonskis' garden shed in Dead Buffalo, Wyoming.

Why are they doing this? Well, one reason is that computers can't relate very well to instructions like "fly the missile east until you see a mountain that looks like a saddle, then fly into the nearest silo." Computers need navigational instructions in purely quantitative form; they need a series of numbers representing displacements from some known origin.

To *digitize* something, then, is to convert its contour into digital (numeric) values. A mountaintop's highest point might be represented as 23,028 units in the x direction, −45,332 units in the y direction, and 12,349 units in the z direction (see figure 1). If you had enough points, you could construct a reasonable facsimile of the mountain range simply by reference to an enormous set of x, y, z coordinates.

Digitization of two-dimensional forms—a drawing on a sheet of paper, for example—is a much simpler proposition and has many practical applications for personal computers. In this article, I'll look at some of those applications and introduce two kinds of devices that make digitization possible: joysticks and graphics tablets.



What—Me Digitize?

In just about any interaction with your computer's display screen, it's handy to have a way to convert your own natural pointing actions into numerical "events" that the computer can understand. Enter the *joystick*.

You've probably seen joysticks used as game controllers in video arcades and on home computers. In addition, there are scores of more general uses. If you want to move the screen pointer, or cursor, to a specific location, say, to select a menu item, identify a block of data, or highlight a block of text, you just move the joystick correspondingly. Using a joystick is certainly much easier than typing in various key combinations to move the cursor. Even the cursor-control keys are awkward compared to using a joystick.

Apple's new Lisa computer uses a mouse pointer in a similar fashion. (For detailed information, see "Meet the Mouse," *Popular Computing*, March 1983, page 102.) A light pen is also designed to ease screen control. However, joysticks are more widely available, less expensive, and have much more software support.

To summarize the applications of a joystick: it's useful wherever nonprecise physical movements must be translated into information the computer can use.

The *graphics tablet* comes into play when you need to track

Columnist William Barden Jr. lives in Mission Viejo, California and writes books about small computers.

Photograph by Ed Crabtree

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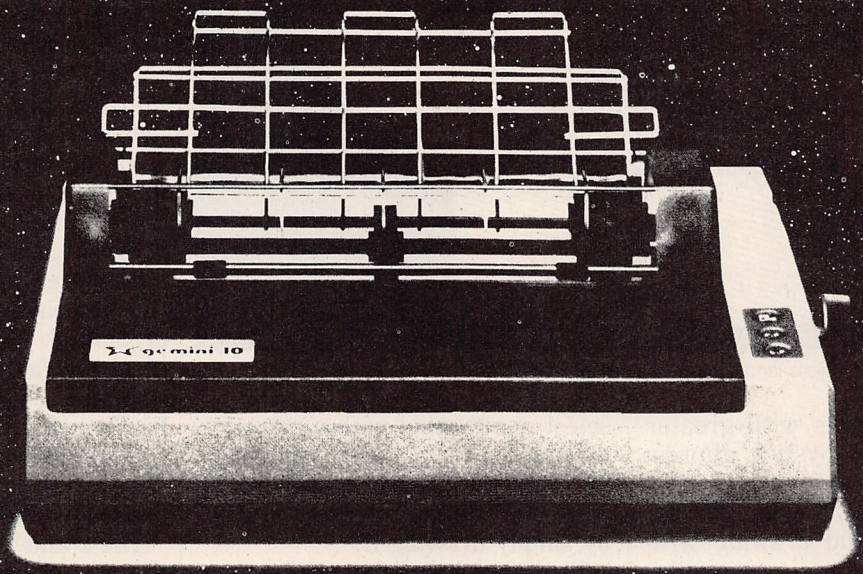

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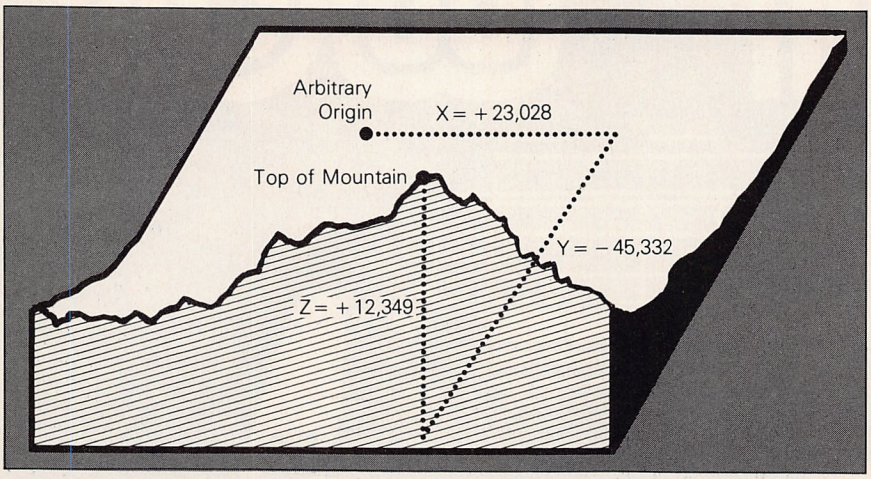


Figure 1: Digitization allows a landscape to be stored in memory.

physical movements with greater precision than a joystick affords. These devices also are better suited to "take-off" work, for example, tracing and drawing with templates. Briefly, a graphics tablet is about the size of an 8½- by 11-inch pad and comes with a special pen attached. You place ordinary paper or a template on the pad, then draw on the paper. As you draw, the pen's position on the paper is transmitted to the computer at frequent intervals. Depending on the program you're using, the picture you're drawing may be instantaneously displayed on the screen or simply recorded in memory for later use.

Imagine taking an existing drawing of your house floor plan, tracing the plan with the graphics-tablet pen, and seeing the plan appear on the screen. Now imagine defining 10 possible room additions or modifications with the pen and then merging them into the basic plan to see how they look—all under computer control.

Or imagine taking the Dow Jones Industrial Averages for the last 50 years and tracing the graph on the tablet; in several minutes, you've converted an entire graph into digital form for instant recall or for numerical analysis. Imagine working from a template of three dozen different shapes representing logic, electronic, or schematic symbols; you could almost instantly select one symbol with a pen position and then instantly position it in the proper place on a drawing, or you could define any new symbol by simply drawing it.

These are just a few applications of joysticks and graphics tablets. Now let's see how they work.

Anatomy of a Joystick

Joysticks are very simple devices. There are basically two "channels" corresponding to the x, y coordinates of a two-dimensional graph. In one type of joystick mechanism, when you move the joystick in an up or down direction, you're varying an electrical potentiometer or "pot" (similar to the one used on a radio volume control) that changes an electrical resistance from low to high. Moving in a left to right direction varies another potentiometer in identical fashion. When you move in a combination of up or down and left or right directions, both potentiometers are changed simultaneously. A few inexpensive joystick designs don't use potentiometers. Instead, contact switches are mounted in a circle around the joystick handle. Moving the joystick closes one of the switches and thus indicates the general direction of motion. These units are often ideal for fast, low-precision game activities but are not suitable for higher-resolution applications.

Usually a joystick has one or two "fire" buttons, which are simple on/off switches.

The x and y channel outputs and the one or two switch outputs are fed into your computer's joystick port. Most smaller computers, such as the Apple II, Atari 400/800, Commodore VIC-20, Radio Shack Color Computer, and TI 99/4A have a joystick port. Some of the larger business-oriented machines do not. Be sure to check on this feature if you're buying a system you want to use for games.

The fire-button inputs from the joystick can be read almost instantaneously by the computer. Programs written in the microproces-

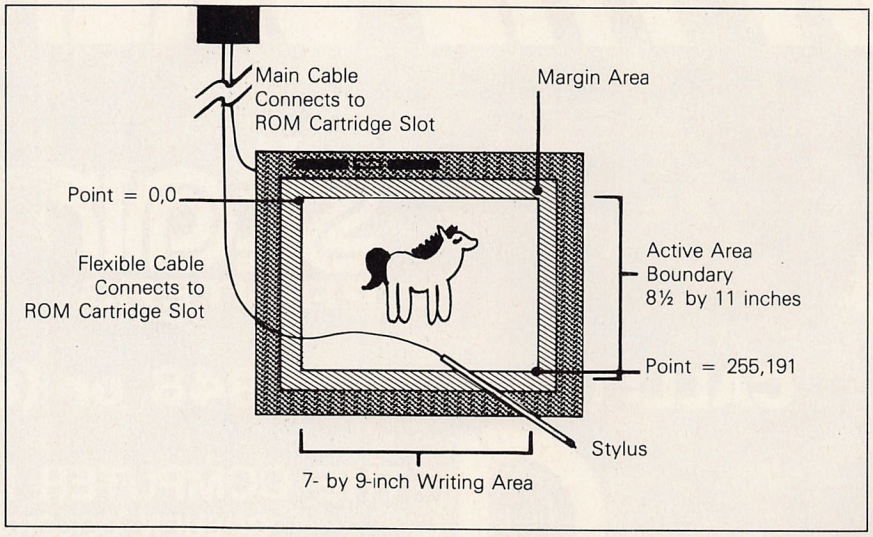
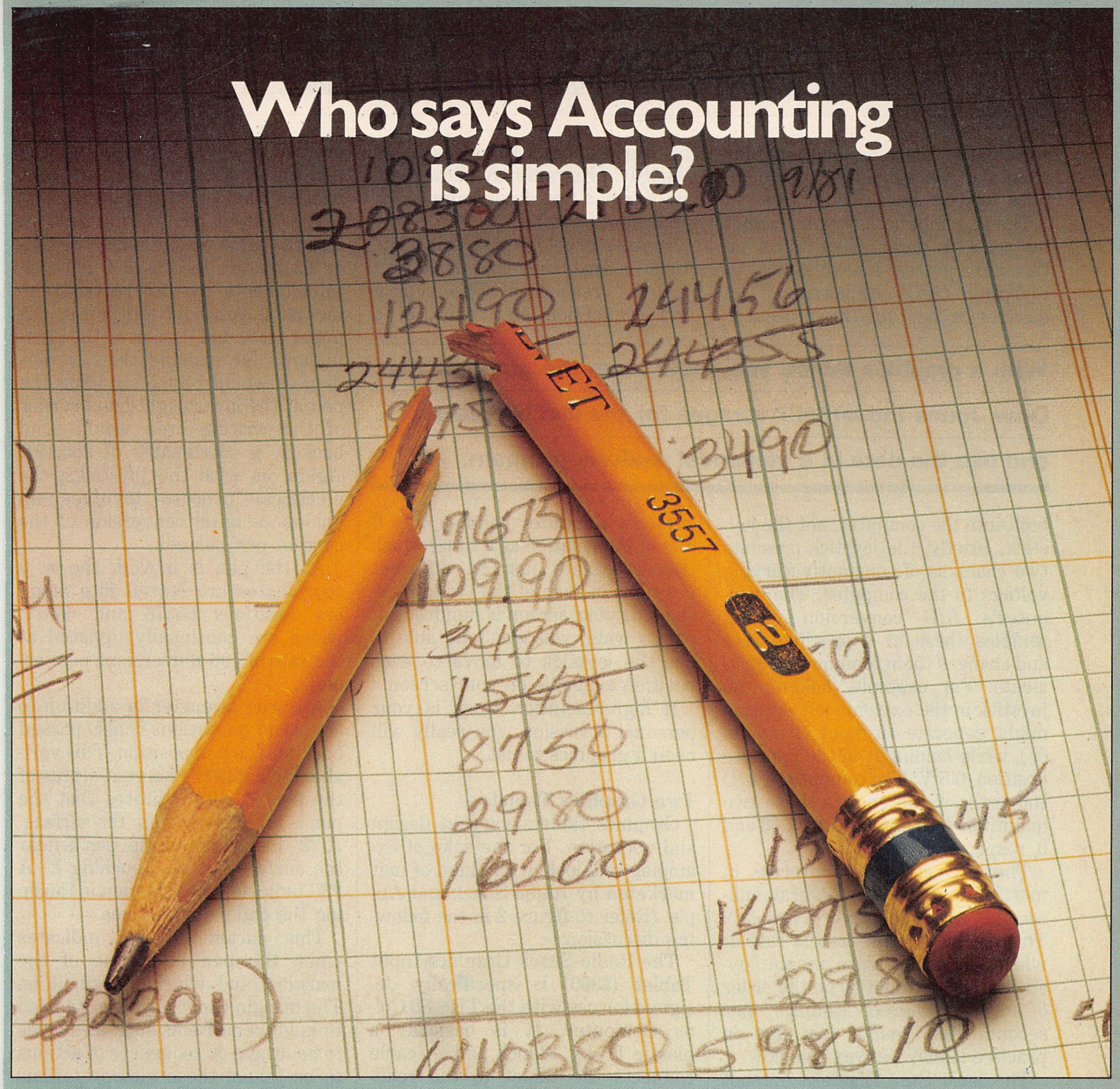


Figure 2: Radio Shack's graphics tablet is typical of most models.



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sor's native machine language, for example, can read the button inputs 100,000 times per minute.

The *x*, *y* inputs, however, cannot be read so fast. They must go through a process known as analog-to-digital (A/D) conversion. The electronics logic for this process is built into the computer, not the joystick. Briefly, the joystick presents two channels of constantly varying voltage to the computer. The computer's A/D conversion circuit samples these at a specified rate and changes them to numeric equivalents. For example, holding the joystick in the extreme left position might generate an input of 5 volts (V), while holding it in the opposite position, 0.5 V. The computer's A/D converter would change these two quantities into numbers, say, 63 and 0, respectively.

The A/D conversion process in most computers takes several milliseconds (thousandths of a second). This means that the fastest rate at which you could figure out the joystick position would be on the order of several hundred "samples" per second. That sounds fast, but in practice it may be way too slow.

The local Star Blasters hotshot down at the video game emporium can move a joystick from bottom to top position in about one twentieth of a second. In that time, the typical personal computer could take no more than 10 samples of the *x*, *y* position. If the computer is attempting to track the joystick's motion on the screen, you'll end up with a series of spread-out dots instead of a continuous line. In short, many personal computers simply cannot keep up with rapid joystick movements used in video arcade games.

This situation is compounded because BASIC is fairly slow, and the overhead or extra processing of a BASIC program may allow reading of only a few dozen samples (*x*, *y* pairs) per second.

Another problem with using joysticks is that they are usually of "coarse" resolution. The typical A/D conversion electronics in a personal computer handles only 6 bits of information at a time, which translates into just 64 different positions in each of the two dimensions. If your screen is hundreds of points wide, you won't be able to use the joystick to move to each position available on your screen.

With a graphics tablet, you could trace the graph of the Dow Jones Industrial Averages for the last 50 years and use the data in a statistical analysis program.

If high-resolution work is your personal obsession, you really will need a graphics tablet.

Two Graphics Tablets

Graphics tablets vary in design and operation. For the sake of example, we'll look at the kind of unit marketed by Radio Shack and Apple. (Refer to figure 2 in the following discussion.)

The Radio Shack Graphics Input Tablet ($350) is specifically designed for use with the TRS-80 Color Computer. It is basically a plastic 11- by 13-inch pad. A cable connects the tablet to the read-only-memory (ROM) cartridge connector on the Color Computer keyboard console. Within the 11- by 13-inch area is an active area of 8½ by 11 inches which is slightly recessed so that a standard-sized sheet of paper fits neatly into it. The 8½- by 11-inch space is divided into an inner 7- by 9-inch writing area and the outer margins.

A pen, which resembles an ordinary ballpoint but has an electrical connection to the ROM cartridge connector, is included with the tablet. You move the pen across the surface of the paper, either to trace lines or to draw original lines. As you move the pen, its *x*, *y* coordinates are sent back to the Color Computer.

The 7- by 9-inch writing area offers the same resolution as the Color Computer screen—256 horizontal elements by 192 vertical elements. If you hold the pen at the upper left-hand corner of the writing area, for example, the *x*, *y* coordinates would be 0,0. Holding the pen at the lower right-hand corner of the writing area would send back *x*, *y* coordinates of 255,191. Again, as with the joysticks, the electrical process involves an analog-to-digital conversion of the current pen position.

As the pen is moved, the *x*, *y* coordinates are stored into memory locations 65376 and 65377, which are continually updated at the rate of 106 conversions per second.

A third parameter in addition to the *x* and *y* locations is also passed back for the pen position. This variable indicates the current status of the pen. A "0" indicates that the pen is lifted away from the surface. A "2" indicates that the pen is near the surface but not touching it. A "3" indicates that the pen is touching the pad's display area.

This parameter also indicates when the pen is in one of the margins, and which margin it is. The margin can, therefore, be used to hold menu items such as shapes to be drawn or sequences of actions to be taken; these interpretations are done by the software.

The horizontal resolution of the pen is 9/256 inch (or about 1/30 of an inch). This means that you can define lines almost as fine as those produced by an ordinary ballpoint pen.

There is no software to control input/output (known as driver software) included with the Color Computer graphics tablet. However, it's not too difficult to write your own. For example, the following BASIC program tracks the pen's motion on the tablet and copies it on the screen.

The program assumes that the

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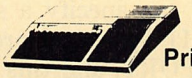

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pen is always down and that the graphics screen on the Color Computer has already been initialized:

```
100 X=PEEK(65376): REM - get X
110 Y=PEEK(65377): REM - get Y
120 PSET(X,Y): REM - plot point
130 GOTO 100: REM - loop
```

What about programming a full-fledged application—one that uses the margins for menu selection and also checks for pen-tablet contact? That would take quite a bit more planning and labor to produce. On the positive side, the Color Computer's graphics commands (LINE, CIRCLE, etc.) would simplify the display portion of your program.

The Apple Graphics Tablet ($795) has a layout similar to the Radio Shack unit's. The digitizing area is 10 by 11 inches, and up to 120 *x*, *y* pairs can be plotted per second. Unlike the Color Computer version, however, the Apple II tablet has a great deal of intelligence built in, by virtue of supplied software and predefined command boxes at the top of the tablet. By placing the pen on a command box, you can select one of the following screen-related functions:

- BKGRND COLOR sets the screen background color
- PEN COLOR sets the drawing color to one of six colors
- DRAW draws a line
- LINES connects any two points with a line
- DOTS draws a single dot each time the pen in placed on the pad
- FRAME draws an open rectangle
- BOX draws a solid rectangle

There are several commands related to changing the size of the active area. Suppose that you want to enlarge a portion of an existing drawing. You can specify a small portion of the 11- by 10-inch area as a new VIEWPORT, and this area will then be enlarged on the screen to fill the display area.

A certain amount of problem-solving capability is built into the Graphics Tablet software. For example, you can easily find the length of a line specified by a starting and ending point, and you can find the area within a boundary.

Some Limitations

Are graphics tablets really practical for personal computing use? Yes and no. If you think you're simply going to sit at the tablet and dash off some drawings that can then be processed by your computer system, you're going to be disappointed.

The bare-bones software will really only let you create a drawing (albeit, fairly easily and with good detail) and store it in memory or on cassette or disk. The drawings are essentially a screenful of data, and high-resolution screens on the Color Computer or Apple II take up a great deal of memory or disk space. The digitized points of the drawing can be stored in a much more compacted form, but this requires additional processing by customized software.

Another problem is that the drawings produced by the graphics tablets may have "ragged" lines due to the finite resolution of the tablet. Where you intended to draw a straight vertical or horizontal line, you may actually get a stepped line. To some degree, good software can minimize this problem. Diagonal lines will almost always have this stepped appearance.

In spite of the problems, however, the graphics tablets are interesting peripherals and are being put to good use in architecture, technical illustration, and other graphics applications. As with a lot of other computer peripherals, only recently have prices been reduced to make them affordable for home use. □

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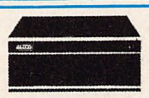

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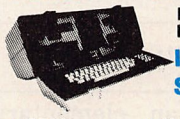

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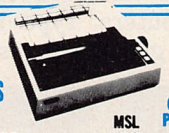

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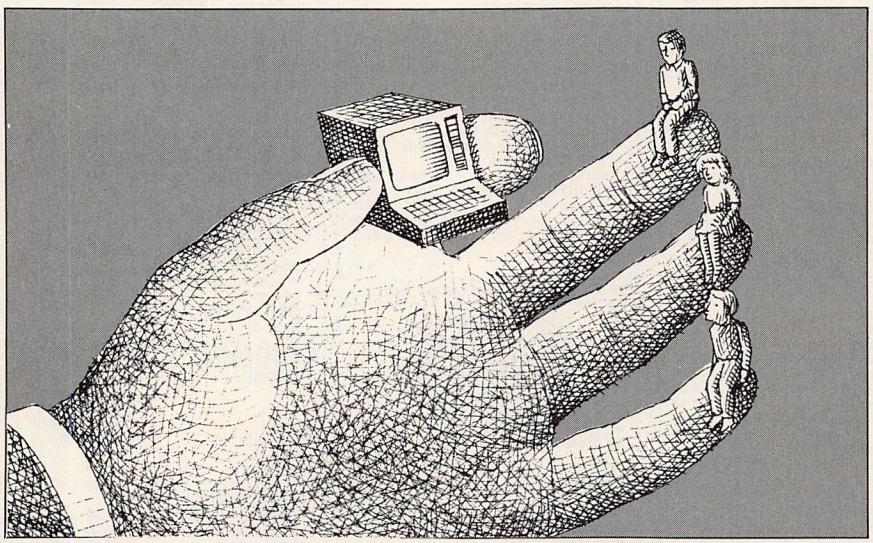
The Wired Classroom

A look at local networking in the schools

by Dan Watt

Imagine an elementary school classroom equipped with a microcomputer for every two or three students. In the morning the students can go over to any of the computers, type in their names, and get messages, schedules for the day, and assignments from the teacher. After reading their messages, students can send answers to each other or to the teacher, modify their schedules, and start on their assignments. A student whose next task requires the use of a computer can stay on the system, load the appropriate software, and begin work at the computer. From time to time, the screen may flash messages from the teacher or announcements about interesting projects other students are doing. When students finish using the computers, they sign off and go on to other activities.



Consider this rather different scene in a 7th-grade math class. Each student works at his own computer on a different set of computer-generated math problems the teacher has assigned. If students need assistance, they type in a "help" message and enter into a dialogue with the teacher or another student. The teacher watches the students as they work and sends online comments or suggestions as needed. When the teacher is not helping students, he can scan listings of the previous day's work and check in on students who need special encouragement. Without leaving his desk, the teacher can look at all the students' work during a single class period.

A third scenario takes place in a high school computer lab. A dozen students exploring a multiuser simulation interact with one another through the computer. Half the students use flight simulators and assume the roles of airplane pilots, and their screens display an instrument panel and a simulation of the view from the cockpit of a plane. The other students are air-traffic controllers whose screens show the view from a control tower and radar information about the locations of all the planes in a particular sector. Because it involves interactive decision making, this multiuser simulation is much more effective than a single-user simulation.

Are these scenarios possible? Are they even desirable? Actually, none of them is all that futuristic. Although such scenes aren't yet common, they illustrate what could happen if enough microcomputers were linked together and programmed with the right kind of software. In principle, these learning situations can be implemented with hardware available today and with software already used in

Dan Watt is a technical editor for *Popular Computing*. He writes regularly on educational computing and is the author of *Learning with Logo* (BYTE Books/McGraw-Hill, 1983).

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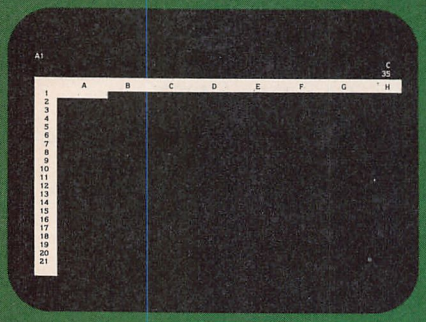

INTERACTIVE ELECTRONIC WORKSHEET **YES**

ON-LINE REFERENCE GUIDE **NO**

"NAMING" OF CELLS OR AREAS **NO**

PLAIN ENGLISH PROMPTS **NO**

INDIVIDUAL COLUMN WIDTHS **NO**

EXTENSIVE FORMATTING CAPABILITIES **NO**

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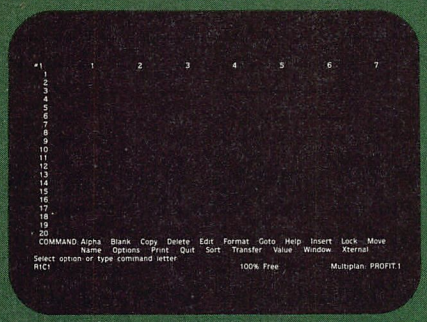
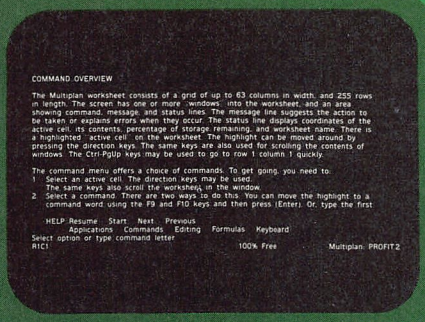
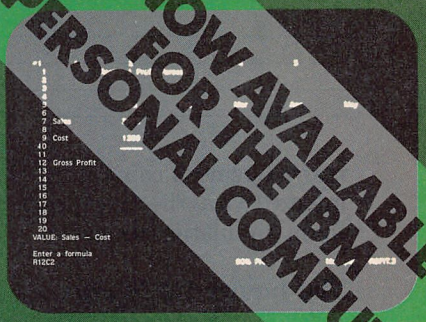


INTERACTIVE ELECTRONIC WORKSHEET **YES**



ON-LINE REFERENCE GUIDE **YES**



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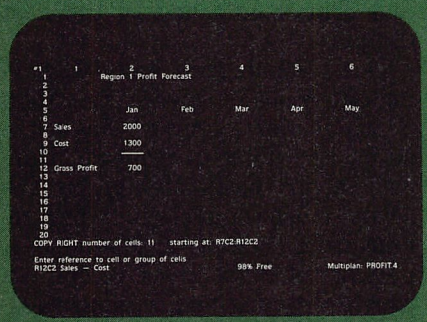

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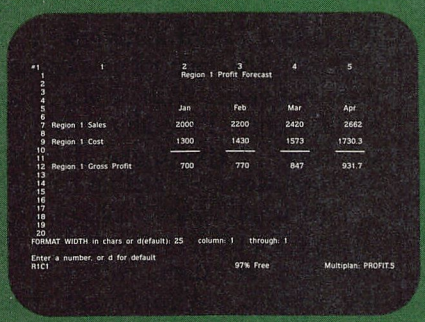

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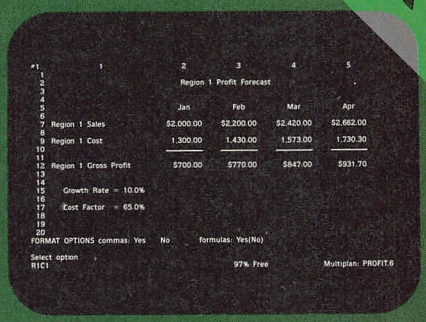

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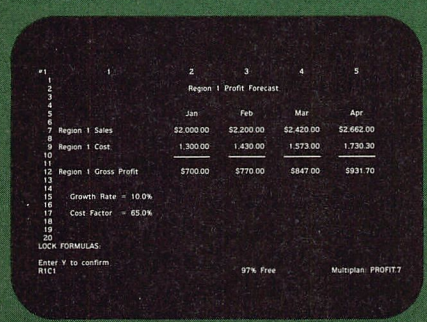

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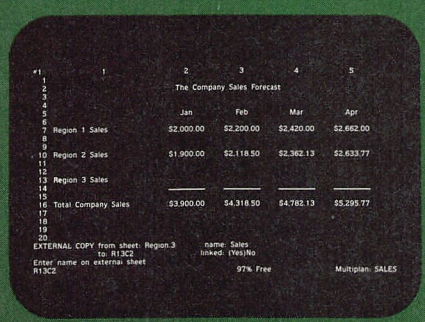

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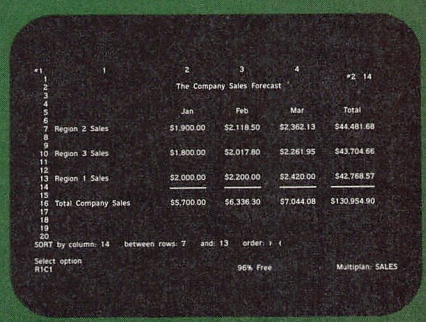

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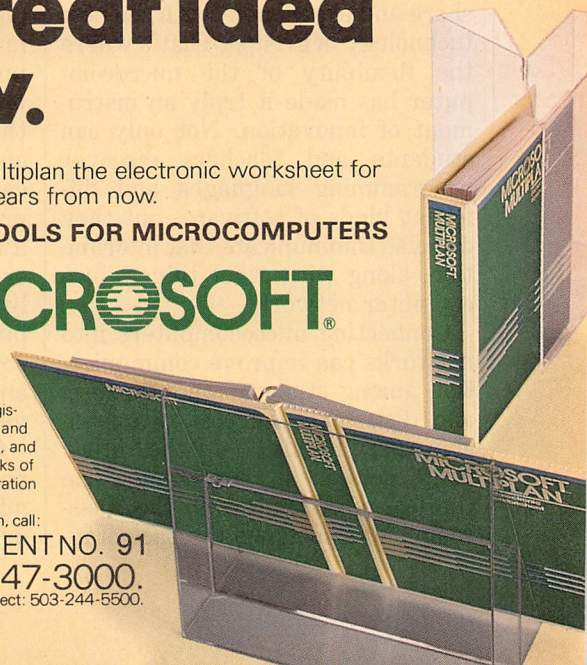

many business computing environments (with the exception of the flight-simulation scenario).

The Innovative Micro

When microcomputers were introduced to classrooms five or six years ago, their advantages as teaching tools over large, time-sharing systems were obvious and persuasive. Microcomputers are relatively inexpensive and can be purchased individually, so school systems can start educational computing programs without making major financial commitments. New computers can easily be added to a school's core of machines and can be expanded as students and teachers grow more sophisticated. Inexpensive floppy disks allow for a dramatic proliferation of educational software as well as a private way to store an individual's work.

It may be precisely the personal nature of the microcomputer that has made it so popular in public settings such as schools. A student using a microcomputer can have a private learning experience and, with his own floppy disk, work on personal projects or store an individualized lesson. Teachers can sign the machines out for the weekend and learn to use them in the privacy of their own homes.

Once students or teachers have experienced the computer on a personal level, they tend to want to share and experiment with the new technology in groups. That's where the flexibility of the microcomputer has made it truly an instrument of innovation. Not only can students and teachers discover programming languages and different kinds of software, but they can also communicate that information, along with other things, in a computer network.

Connecting microcomputers into networks can improve communication among students and teachers and distribute the cost of expensive peripherals. On the other hand, networking can standardize the use of computers in the classroom and slow down the pace of innovation. In this article, I'll explore the pros and cons of local networking in the classroom: what it is, how it can be implemented, and where it is being used. In addition, I'll cover some of the problems that schools should know about before taking the plunge.

What Is a Local Network?

There are many variations of local networks with subtle shades of difference. Basically they fall into three categories. *Resource-sharing networks* enable a number of microcomputers to share expensive peripherals such as printers, plotters, or disk drives. *Communication networks* let microcomputers communicate with one another, either online (live) or through messages stored on a shared disk (this is also called electronic mail). *Interactive networks* allow people to collaborate on multiuser tasks such as the airport simulation I described earlier. All of these networks are "local" because they connect microcomputers located in the same room or building through a system of wires. *Remote* networks, on the other hand, connect geographically separate machines, usually over telephone lines.

Resource-sharing networks are the simplest. Radio Shack, for example, has two different types available for schools. The company's Network 2 connects as many as 16 TRS-80 Model III computers to one host computer. The network cables plug directly into the cassette port of the TRS-80, and each student can use normal cassette commands to load or save programs. Instead of coming from a slow, unreliable cassette recorder, the software is delivered rapidly and directly from the host computer. The controller of the host computer can send the program to any or all of the computers on the network simultaneously.

One of Network 2's limitations, however, is that all software transmitted between the shared disk drive and the student must be stored temporarily in the host computer. Radio Shack's Network 3 overcomes that difficulty. By incorporating an RS-232C interface and a special chip containing communications software, Network 3 enables each student to communicate directly with the disk drive and printer attached to the host computer.

These capabilities have made a big difference to Oliver Ames High School in North Easton, Massachusetts, according to principal Duncan Oliver. Each student at the school must complete a typing requirement before graduation. A network of Radio Shack computers provides typing and word-processing instruction. At the beginning of a class, the word-processing program Scripsit (which has been modified for network use) is rapidly loaded into all the computers. During the class a student can save text on a disk or obtain a hard copy from the printer at any time. The network software that comes with the system manages the flow of information among all the computers and the shared disk and printer.

The city of Worcester, Massachusetts, has also recently installed Radio Shack networks in each of its elementary, junior high, and high schools. According to John Burke, information-systems manager for the school district, the networks are primarily used for introductory programming and computer-literacy classes. The district would also like to get more deeply involved with CAI (computer-assisted instruction) but so far has found relatively few high-quality CAI programs that have been adapted for network use.

The Software Gap

Getting software to run at all is one of the major problems for network users. Most commercial microcomputer software is protected against unauthorized copying, and because local networks involve loading software into one computer and transferring it to others—exactly what copy protection is in-

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Typical Network Systems for Classroom Use

Editor's Note: Network systems vary greatly in capabilities, so be sure to consult a dealer for up-to-date information. The costs of the computers needed for the host system and individual stations are not included in the approximate prices given below. Exact costs will vary depending on individual configurations, numbers of units, and dealer discounts. Other systems may be available in addition to the Apple, Commodore, and Radio Shack computers listed here. To the best of our knowledge, classroom network systems are not presently available for either Atari or Texas Instruments computers. Check with your local dealer for further information.

Computer	Network System	Hardware and Software Required for System	Hardware Required for Each Station
Apple II, II Plus, and Apple IIe	Schoolbus Apple Computer Inc. 20525 Mariani Ave. Cupertino, CA 95014	Apple II with 48K bytes of memory and disk drive, system disk drive(s), and interface card; Schoolbus operating system software. $500–$600.	Apple II (*without* disk drive), interface card, and cable. $150–$225 per station, depending on length of cable.
	Omninet, Corvus Systems 2029 O'Toole Ave. San Jose, CA 95131	Apple II with dual floppy-disk drives and Omninet interface card or 6-megabyte Corvus hard-disk drive and Corvus Omninet Disk Server; Omninet system software. $495 (floppy-disk version), $3185 (including hard disk).	Apple II (*without* disk drive), interface card, and cable. $395 per station.
	Classroom Monitor Software Connections Suite #17, 1800 Wyatt Dr. Santa Clara, CA 95054	Classroom Monitor uses the Corvus Omninet system. The additional cost for Classroom Monitor software is $375 (floppy-disk version) and $475 (hard-disk version).	Same as for Corvus Omninet (above).
Commodore 64, PET, or VIC-20.	Mupet Canadian Micro Distributors 500 Stelles St. Milton, Ontario Canada L9T 3P7	Commodore computer with 32K-byte memory and IEEE interface and printer; $995 includes hardware for host computer and three stations.	Commodore computer with IEEE interface module. The cost of three modules is included with the system. Additional systems cost $200 per station.
	Questar Questar International 7270 Woodbine Ave. Markham, Ontario Canada L3R 1A4	Commodore computer with 32K bytes of memory, disk drive, and IEEE interface, network controller box, $795.	Commodore computer and cable. $50 per station.
Commodore 64 or VIC-20	VIC Switch Computer Marketing Services Inc. 300 West Marlton Pike Cherry Hill, NJ 08002	Commodore computer with disk drive, network controller box, $149.95.	Commodore 64 or VIC-20 computer with special cable. About $20 per station.
Radio Shack TRS-80 Model III or Color Computer	Radio Shack Network 2 Radio Shack Education Division 400 Atrium One Tandy Center Ft. Worth, TX 76102	TRS-80 Model III with disk drive, Network 2 multiplexer box, and cables for 16 stations; Network 2 system software, $499.	TRS-80 Model III or Color Computer. No additional cost per station.
Radio Shack TRS-80 Model III	Radio Shack Network 3 (see address above)	TRS-80 Model III with 48K bytes of memory and dual disk drives, Network 3 controller box; system software, $599.	TRS-80 Model III computer with 16K bytes of memory, RS-232C interface, and auto boot ROM. About $200 per station.

tended to prevent—most educational software will not work on network systems (see "Typical Network Systems for Classroom Use" on page 76). To overcome this kind of difficulty, schools have had to call on a new kind of technological middleman, the network software adapter.

Richard Cassabonne is marketing manager for Unicom, a Providence, Rhode Island, firm that specializes in selling computers to schools. Cassabonne's company now plays a major role in adapting copy-protected software for the Corvus Omninet, the network system most commonly used with Apple computers. Omninet includes both hardware and software and can be used with either hard-disk or floppy-disk systems. The hard-disk version requires an Omninet disk-server as well as the hard-disk drive itself. The floppy-disk version lets a group of floppy disks that are connected to one computer serve the entire system.

The process of adapting software can be quite complex. First of all, a licensing agreement must be negotiated between Unicom and the software suppliers. Next, the software developers send Unicom an unprotected version of the software, which Unicom then modifies for use with Omninet. At this point the problem is only half solved because the software has to be reprotected so that a school can't copy it or redistribute it in unlimited quantities. That takes a certain amount of ingenuity on Unicom's part.

"As a protection for the software developer, we inscribe a serial number that's not visible to the user in the Corvus version of the software," says Cassabonne. "Then we match that with a 'Unigrom' encryption card that is installed in every Apple in the network. The card checks for the serial number. If it's not there or it's not the same, the software can't be loaded into the computer." Unicom sells both the encryption card and the reconfigured software. Prices depend on the number of computers using the network.

An advantage of this system, according to Cassabonne, is that a school can use software from several companies as long as all of it has been modified by Unicom using the encryption code assigned to that school. A school that follows this approach, however, is locked into a long-term relationship with Unicom as its software supplier. Unicom is now making arrangements to market network software nationally. Some products the firm is pushing right now are a version of Logo that has been modified for Omninet, an authoring system for creating CAI programs, a menu program to make Omninet simpler to use, and several educational-administration packages.

Not all software is suitable for use in a network, however. Some word-processing programs, for example, allow almost unlimited document size by transferring information to and from a disk automatically. Because each user needs almost continuous disk access, such programs are unlikely candidates for use on resource-sharing networks.

In order to be able to use copy-protected educational software in a network, schools have had to call on a new kind of technological middleman, the network software adapter.

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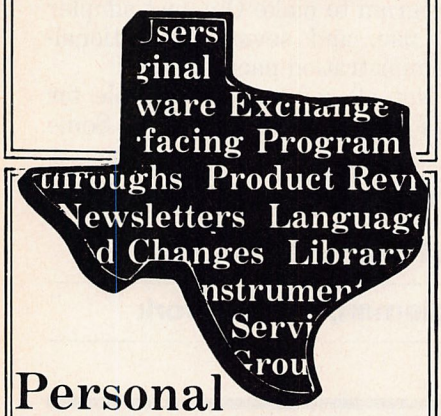

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Computer to Computer

So far, all of the systems I've described have been the resource-sharing type. But systems can also be linked together to communicate with one another. One simple way to do that is for a student or teacher to store a message on the central disk so any other user of the system can have access to it. Electronic-mail systems use a variant of this approach. Direct online communication between computers, however, requires additional software and is not yet a common feature of classroom networks.

Software Connections, a Santa Clara, California, company, recently introduced a program called Classroom Monitor, which is used with the Corvus Omninet system and allows a limited amount of computer-to-computer communication. The program demonstrates both the virtues and the limitations of networking software. Once it has been loaded into the teacher's computer, he or she can watch a student at work without the student's knowledge. A teacher can also send a student a one-line message that appears in inverse video at the top of the student's screen. But while the teacher can send any number of messages, only one message can be seen at a time, and each one must be less than 40 characters long.

Although teachers can talk to students at will through the Classroom Monitor, it's difficult for students to talk back. To send a one-line message to the teacher or another student, for example, a student must first save his current work and then load a special "talk" program. If he wants to ask a question about his work, however, he has to reload the program he was working on so that the teacher can view it. In so doing, the student sacrifices his own ability to communicate.

Other features of Classroom Monitor include a demonstration capability that enables the teacher to show all the students what any one student is doing. At present this feature is limited to displaying text and low-resolution graphics images. Like Radio Shack's Network 2, Classroom Monitor also lets the teacher download one program to any number of student computers simultaneously.

Classroom Monitor can be used with Apple DOS 3.3, BASIC, and Pascal programs but cannot be used with other languages such as PILOT or Logo or with any copy-protected educational software. It should be possible to eliminate these drawbacks, given some time and the kind of collaboration among software producers that Unicom has been able to achieve. Some of Classroom Monitor's limitations, on the other hand, may be due to a conscious effort to make sure that the teacher stays in charge. For the time being, free communication among the users of a classroom network—in a way that is possible with many timesharing systems—has yet to be achieved in a commercial educational product.

Interactive Networks

If communication networks are not quite with us, truly interactive networks that are capable of running multiuser simulations are even more futuristic. Such systems can, however, be achieved in research laboratories. Professor Thomas Dwyer of the University of Pittsburgh recently completed a research project designed to create both hardware and software for multiuser simulations. His Solo/Net/works project was the inspiration for the air-traffic-control simulation described earlier. Another example is a multiuser version of a Star Trek game in which different players take on collaborative roles in piloting a space ship through a hostile universe.

The Star Trek game was implemented on a PDP-11 timesharing system, but the thrust of Dwyer's research has been to develop a hardware/software system capable of running multiuser software on a microcomputer network. Although the research project has been completed and Dwyer is satisfied that

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it is technically feasible, it may be a long time before this kind of software is generally available to educators. One California firm, however, is creating Star Trek–based network consoles for arcade use, a commercial venture more financially viable for entertainment purposes than for school systems.

A 16-station Radio Shack Network 3 disk-sharing system results in a savings of more than $8000, when compared to the cost of 16 TRS-80 Model III computers with disk drives.

How Much Does It Cost?

The primary justification for current classroom networking is financial. For multicomputer laboratories, the savings in terms of both money and time can be significant, depending on the number of computers involved. Let's run through a cost estimate for a Radio Shack Network 3 system with 16 users.

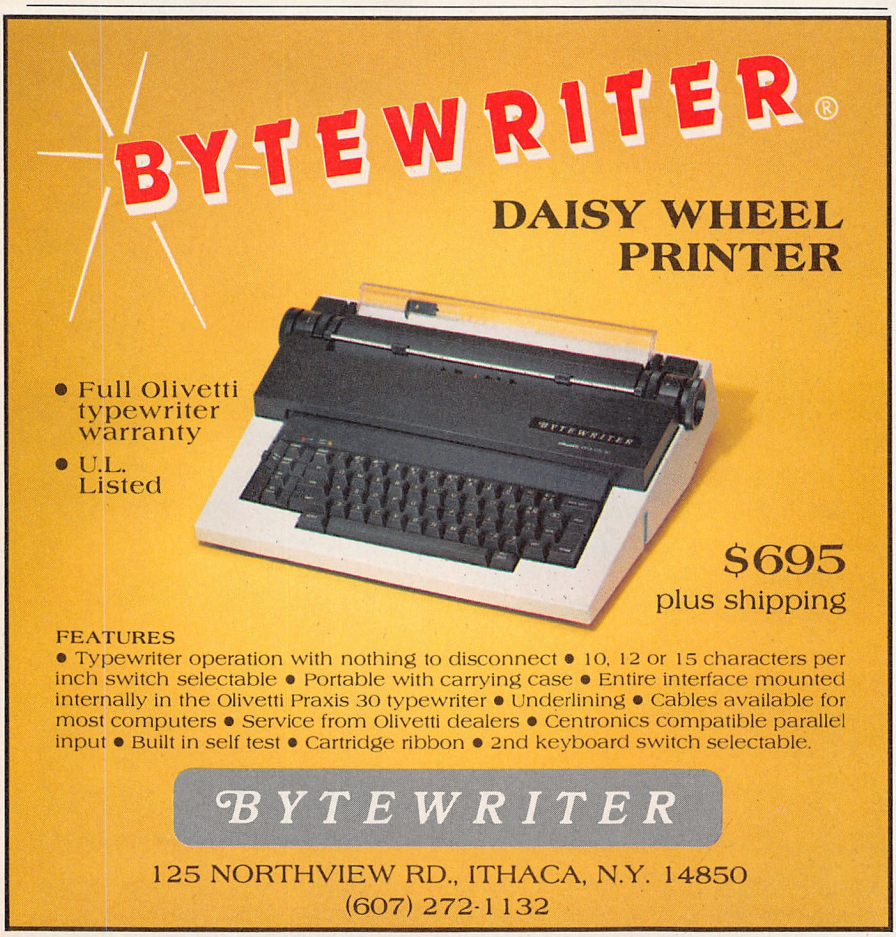
A TRS-80 Model III computer with 16K bytes of memory costs about $900. A 48K-byte system with one disk drive costs about $1800, and with two disk drives it costs about $2200. Sixteen single-disk TRS-80s would cost about $28,800. Substituting the Network 3 system for the 16 disk drives would require adding one additional dual-disk system to serve as a system master ($2200), some additional network hardware ($600) and software ($150), and about $200 per station for an RS-232C interface, cables, and a special chip ($3200). The cost of a networked system adds only $6150 to the base price of the 16 computers, for a savings of more than $8000. These estimates, of course, are based on list prices; with standard educational discounts, the final costs could be a lot less. And when you consider the advantages of having 16 users share one printer, the savings could be even greater.

A similar calculation could be made for Apple computers using Omninet or for Commodore computers, which also have network capability. Unicom's Richard Cassabonne estimates that with 10 or more Apples, a Corvus hard-disk network with Omninet costs less than purchasing a floppy-disk drive for each Apple.

If the network system is used simply to teach BASIC programming, there's no additional cost. If additional software is needed—to teach Logo or Pascal or for word-processing and other business applications or for CAI—the cost of licensing the modified software must be taken into account. The cost is likely to be more than an individual disk but significantly less than purchasing a separate software package for each computer. Before opting for a network, however, make sure the software you want is available or can be modified.

Networking Pros and Cons

The advantages of networking are fairly clear, chief among them being reduced cost and the efficient sharing of peripherals. Other advantages include the ability to save and retrieve individual programs or data more quickly by using disks instead of cassettes or a hard disk instead of floppy disks. Centralized data storage also eliminates housekeeping problems caused by the proliferation of individual disks or cassettes. Limited computer-to-



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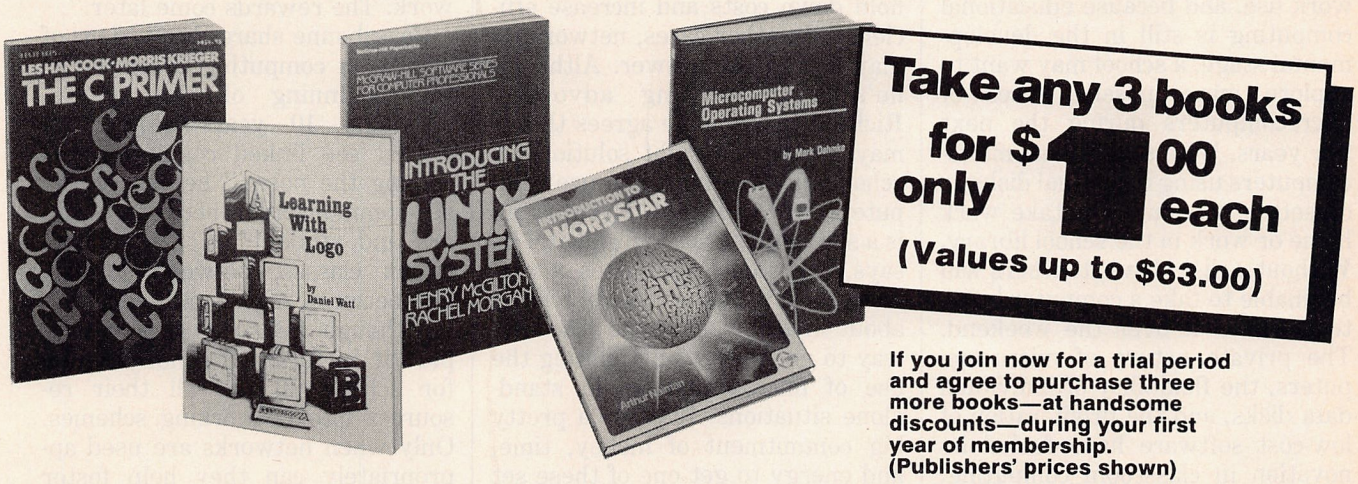

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computer communication available through systems like Classroom Monitor is an additional plus.

On the other side of the coin, networking may limit the potential uses of a system. So far, relatively little software is available for network use, and because educational computing is still in the developmental stage, a school may want to explore many possible uses of microcomputers during the next few years. With stand-alone microcomputers using individual disks or cassettes, students can take work home or work in the school library. Without a disk drive, teachers will be unable to take a computer home to work on it over the weekend. The private nature of microcomputers, the flexibility of individual data disks, and the proliferation of low-cost software have fueled innovation in classroom computing. Schools that move to networking prematurely in the name of efficiency run the risk of limiting themselves.

For schools setting up a fairly large computer lab designed for programming or business education, networking makes a lot of sense, especially if it can be used to hold down costs and increase efficiency. In other cases, networking may not be the answer. Although he's a networking advocate, Richard Cassabonne agrees that it may not be the right solution for schools just beginning to use computers. "Let's face it. Networking is a second-generation product," he says. "A school that uses a network has to be extremely clear about what it wants to do. The best way to get there is by piloting the use of microcomputers in stand-alone situations. It takes a pretty big commitment of money, time, and energy to get one of these set up and working the way a school wants it to, and a school needs to have a resource person who can work closely with an outside vendor. People sometimes think that a computer is going to eliminate a lot of burdens, but actually a school has to be willing to take on some burdens to make an innovation work. The rewards come later."

Cassabonne shares the visions of classroom computing described at the beginning of this article. "Looking 10 years ahead, we should see linked computers becoming the norm," he asserts. "I see communication between teachers and students in a class, between classes, between schools, and between schools and homes."

Although networking is clearly part of the future, it is not yet time for schools to put all their resources into networking schemes. Only when networks are used appropriately can they help foster continuing educational innovation. □

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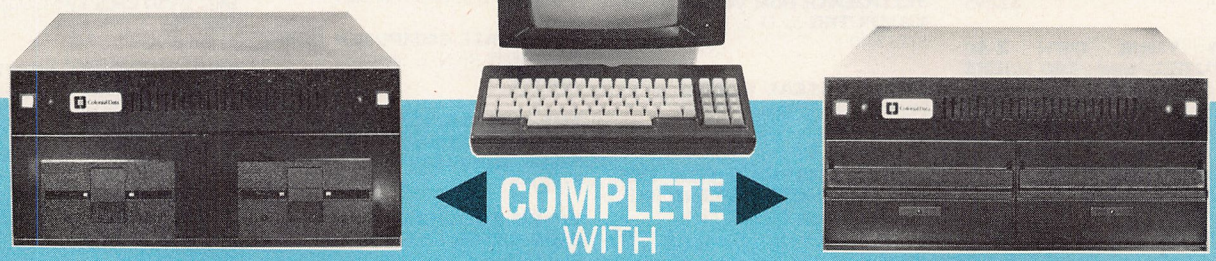

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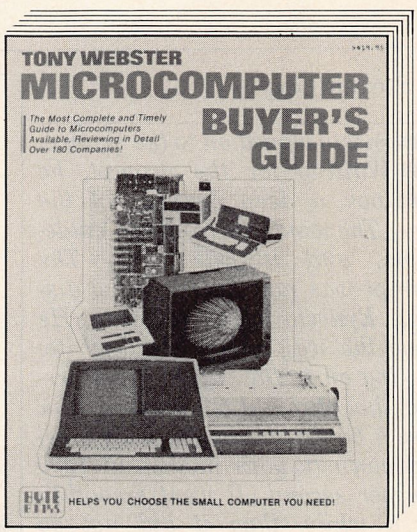

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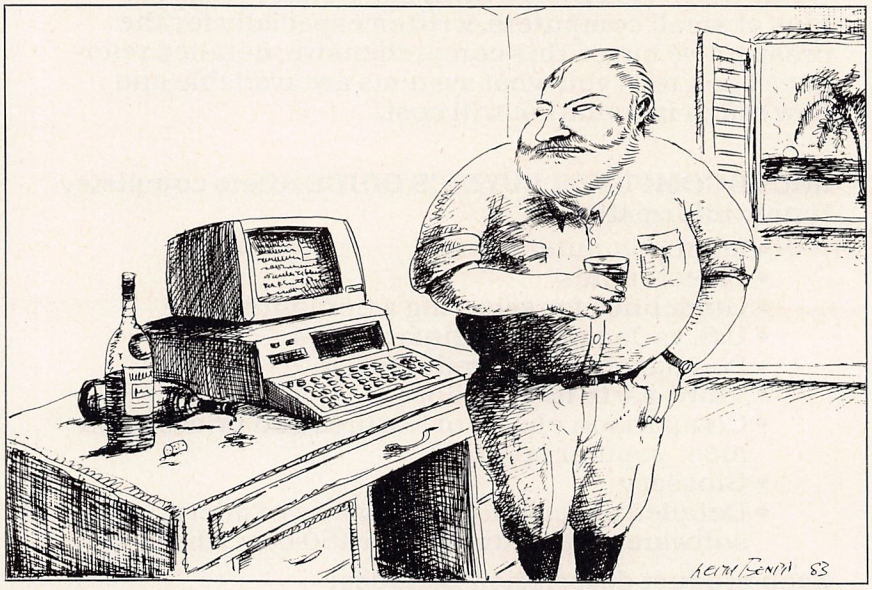
The Great Electronic Novel

Telecomputing fiction? Interactive soaps? Hemingway would flip.

by Steven Levy

Ernesto logged on to the service. Waiting for the prompt, he took a deep draught of the wine. The wine was from the Valdepenas, and it was good. The prompt was now on the video display. Ernesto began to write. He knew the way men should write: you log on to the information service, you stand at a keyboard, you have a bottle of wine by your side, and you run your modem at 1200 bits per second. It went smoothly for a while, then it did not go smoothly. Ernesto knew not to make it come when it will not come. He decided to see what the others were up to. He accessed Scotty's new novel. Then he accessed a rough draft of a story that Dos had put online. Ernesto sent electronic mail to them, letting them know that their writing was good, but not as good as Ernesto's. Then this came on the screen: "PAPA-540—DO YOU WANT TO CHAT?" Ernesto cursed softly to himself. And he logged off.

Sorry, Papa, but I use you to make a point: the telecommunications revolution is going to change the way that *all* people write, not only business executives distributing memos to squadrons of sales representatives or hobbyists swapping gossip about the newest hot piece of software, but creative writers as well. Indeed, when publishers adopt the new technology, writers may find that avoiding computers and modems is more difficult than sticking to longhand was in the salad days of electric typewriters. In fact, using telecomputing technology might well be imperative.



The possibility rankles those who feel that artistic creativity and modern technology are mutually exclusive. Most frightening to traditionalists is the possibility that the medium will actually change the writing itself. I've been worrying about this myself. After all, the precomputer age has turned out some pretty good books. So it has been with no small trepidation that I've looked over some of the electronic efforts of creative writers. Some of these pioneers have decided to go *mano-a-mano* with the same bull that Hemingway himself got in the ring with—the novel.

The Electronic Novelist

Perhaps the most ambitious electronic novelist is Burke Campbell, a 34-year-old Canadian. Campbell thinks that the publishing industry today consists of nothing but "dinosaurs" and that publishers are insisting on an antiquated form of delivery—the book. But the publishers' most insidious practice, Campbell told me by telephone from Toronto, is their absurd insistence on dictating what should

Columnist Steven Levy is a contributing editor of *Popular Computing*.

Illustration by Keith Bendis

or should not be published and who may publish it.

Campbell feels that this enforcement of so-called standards is arbitrary at best: "It creates this bureaucracy between the writer and the audience. I don't buy that literary snobbery. I want to dispel the myth that a writer must submit his work to that humiliation."

To dramatize his opinions, Campbell, who makes a living writing radio melodramas for the Canadian Broadcasting System, decided to publish a novel electronically via The Source. Moreover, hoping to highlight the unique advantages of this new medium, he chose to write the novel in less than three days. In this way his work would be almost immediately available to Source subscribers, who could read a novel that, one week earlier, existed nowhere—not even in Campbell's imagination. "I did have a skeleton plan of the novel in my head," admits Campbell. But mostly the writer winged it, and history will note that he winged it in style.

"Writing does not come easy for me unless I'm relieved of all anxiety, so I literally made my setting into a palace," the writer reports. At 8:30 on the evening of November 14, 1982, Campbell was driven to the site—a specially renovated art gallery in Toronto—in a limousine "about a block long," he judges. For the special occasion he wore a black-sequined track suit and cowboy boots.

Waiting at the gallery were some of his favorite trappings from home, including an oil portrait of Burke Campbell (the official Burke Campbell bronze bust was still at the foundry). Also there were an Apple III computer, a valet, a masseuse, Campbell's personal photographer, several dozen champagne-guzzling well-wishers, and a gabble of reporters and television cameras. "Everybody proceeded to get drunk, and it turned into a full-scale literary riot," says Campbell. "The party went on until after midnight, when I think people got into their cars and drove into Lake Ontario."

From then on, it was Campbell, his valet, masseuse, and photographer, and a constant stream of disc jockeys calling for late-night radio interviews. Campbell accommodated them all, and sometime in the next 60 hours he also wrote a novel. On November 17, at 11:07 a.m., *Blind Pharaoh* was finished. It was dedicated to "The World" and placed in the public domain.

Campbell and his friends edited the story that afternoon and sent it to The Source in McLean, Virginia, at 1200 bits per second. The Source's editors reformatted it into pages and easily readable chapters. By 8:30 that night, "Sourcetronauts" who typed NOVEL at the command level could read *Blind Pharaoh*. One early reader, the book editor of the *Chicago Sun-Times*, praised its "splendid narrative drive" and said that he enjoyed it very much.

I read the novel straight off my display screen—a daredevil leap into the new age, but one that made my eyes hurt. If electronic novels are going to catch on, something must be done about this problem. Source spokesperson Michael Rawl (who has a cameo role *Blind Pharaoh*) says that most readers of the novel will print it out before reading it, but that seems equally unsatisfying. Who wants to deal with a mile-long roll of paper? Give me a paperback book anytime. An average paperback is far cheaper too. Accessing *Blind Pharaoh*, even at the cheapest Source rates, would cost your normal 300-bits-per-second user almost $10. And that's for a novel of 20,000 words, only one fifth the size of the average blockbuster.

That's the price of pioneering, I guess. Behind the track suit and champagne, Campbell's achievement is considerable—he has shown us how writers in the future may take control of their work by exploiting the democratic nature of telecommunications.

While *Blind Pharaoh* will not win any literary awards, Campbell managed to blend some salient satire into an easy-reading science-fiction plot. Appropriately enough, the novel touches on a technological theme concerning the very process by which the reader has ac-

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cessed the novel—a clever twist that I won't give away here (read Chapter 18 for details). Campbell succeeds, I believe, in his goal of making electronic contact with his readers.

The Multiauthor Novel

Campbell's novel, despite the pyrotechnics of its plot and a disturbing sexy android, is rather traditional. But other online writers are taking advantage of the new medium by experimenting with different modes of creation. One phenomenon I've noticed lately is a form of fiction that befits the easy communication afforded by computer networks: the multiauthor novel.

Not nearly as publicized as Campbell's work on The Source is a quickly developing "fun book" stored in the Literary Special Interest Group on Compuserve. It's called The Great LitSIG Novel Experiment, and would-be Heinleins and Vonneguts each take a turn at writing a chapter of the book, using no more than five messages on an electronic bulletin board. Other ground rules include an admonition not to kill off anybody else's characters and a firm statute against writing out of turn. (If that happens, say the guidelines, "we'll have a kaleidoscope rather than a vision.")

A fellow named Gandolf started the narrative by introducing two characters: an extraterrestrial traveling through space and a divorced woman doctor. The story lurches on from there, each chapter with the stylistic fingerprints of a different author. The alien, it turns out, is some protean figure who snatches the brains of several of the novel's main characters through some vaguely sexual act. This was the least confusing element of the story, though. In other places, I found a detailed explanation of Fibonacci numbers (a mathematical phenomenon discovered by Leonardo Fibonacci of Pisa in 1202, I learned), loads of realistic courting dialogue, and three major characters named Jack.

This last development was apparently too much for the Compuserve novelists. Exchanging messages on the electronic bulletin board, they wondered how the situation could be resolved and decided there would have to be a powwow. The authors held a conference via computer using Compuserve's "CB" capabilities. Like its radio counterpart, the CB function enables a group of people to tune in to the same "channel" where any remark typed in on one terminal will show up on all the participants' screens.

The conference was what you might expect from a group of strong-minded creative writers. Alex, the group's Sysop (systems operator—the leader), took charge immediately, insisting that if he were to go out of turn and take the next chapter, he could resolve all the problems. He promised that in his chapter he would prove that there was only *one* Jack. At this point an author called Scorpia electronically remarked, "You do card tricks, too?" (For some reason, Compuserve's CB function creates an irresistible urge to pun.)

The conference went on for more than two hours, and the participants' comments turned out to be more revealing than some of their contributions to the novel. The rigid constructionist George explained that he was a "professional planner" and as such was appalled at the idea of writers "doing their own thing." George outlined, complete with little letters surrounded by parentheses, his idea of how a well-planned collaborative writing experiment should be carried out. Then Dick, who had come under some fire for blatantly exceeding the length limits in his contribution, argued that the point was not to create a product but to "ex-

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perience a process that we can be pretty loose about." This didn't sit too well with George.

Then Dagny said that while she liked the surprises she found in new contributions, she was disappointed that some people were apparently ignoring the fact that the alien had three sexes. Dagny was also unhappy with the differences in writing styles, as was Julie, who also complained that "certain writers (such as Dick) had *not* paid careful attention to what had gone before." Characters were even switching professions!

It was up to Jerry to suggest that they needed a "very strong editor with a big red keyboard." (Is this the electronic equivalent of a blue pencil?) Alex the Sysop quickly accepted the mandate to monitor the ongoing experiment, "but I will not play tyrant," he promised. The group also decided that the individual contributions could be longer and that characters *could* be killed off with the permission of their creators.

Let me be honest. After that session, I did not see a rosy future for the electronic collaborative novel. How could problems be resolved between planning and serendipity, between stylistic anarchism and committee-approved conformity?

The Online Soap Opera

Soon after the Compuserve session, I learned of another multiauthor effort on a computer network called EIES, sponsored by the New Jersey Institute of Technology. This collaborative fiction started almost by accident during a conference called "Telecommunications and the Artist." This conference was not a simultaneous online affair like Compuserve's CB but a long-term colloquium in which participants filed comments in the form of electronic memos, either responding to previous comments or introducing new topics.

Somehow a discussion about grants led one member to devise a hypothetical character called Starving Artist. Around that time Martin Nisenholtz, another conference member, was proposing a new use for the conference; he wanted to create "an interactive soap opera" in which participants become characters from fantasy or the real world. Nisenholtz had high hopes: "I want to see characters converge in telecommunications space, fight battles, make love, spend money, and get divorced so that our different points of view, fantasies, and dreams converge into an entity that develops through interactive communication." So it was, and the protagonist was none other than Starving Artist.

I've thumbed through a transcript of this soap opera, and it's fascinating reading. Art Kleiner

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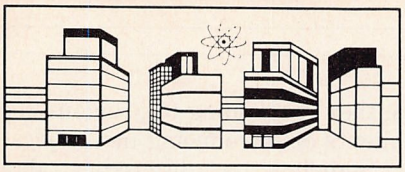

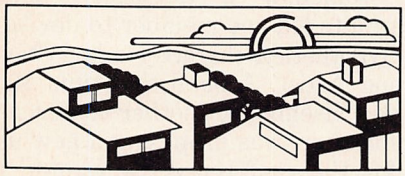

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(who in his offline life edits the magazine *Coevolution Quarterly*) told me that his involvement in the project was cathartic. "I was a reader, a participant, and even a character," he says.

Kleiner took over the role of Starving Artist and was soon launched into a romance with a character named Wistful. "This character, played by one participant for the entire story, kept taking on more and more power," Kleiner says. Meanwhile, a conference member who was initially hostile to the whole idea of an electronic soap opera ("Crap," he called it. "Zane Grey wouldn't even publish this stuff!") joined in as a character called Lord Vader. He hired one character as a hit man to kill Starving Artist and later began a torrid affair with Artist's girl, Wistful.

Eventually some of the participants (notably Kleiner) began to find that they were being used as characters under their real names. The line between reality and fiction was getting blurred, and when the fictional Art Kleiner was murdered in his apartment, it was an emotional blow to the real Art Kleiner.

Talking to me about it, though, led Kleiner to suggest that a new electronic soap opera be formed on EIES, and within days Starving Artist was living again, this time in a town called Disbelief, Vermont. The town was controlled by a crotchety old broomstick magnate named Will Ingsuspension. By the time I caught up with the story, it was five days old and 22 comments long, and already a spaceship had landed. (What is it about these things that always evokes spaceships?) I jumped right in, creating a character who worked as a reporter for the Disbelief Bugle and had been seriously involved with a woman named Wistful. (Yes, our old friend Wistful had arrived in town and was already creating quite a stir.)

Hours after I placed my comment online, I reaccessed EIES to see what had happened. Sure enough, there were more contributions to the story, and one mentioned me as that "idiot reporter." Well! I rushed to compose my next contribution, fleshing out my character some more and suggesting some sexual scandal in Disbelief. This was getting addictive.

But was it more than just an expensive game? (EIES is not cheap, and in two days I had logged over $30 worth of usage.) I think so. As the narrative progressed, I found myself wondering about the other anonymous contributors and inserting sly messages to them, signals that they could respond to. I began to become attached to the evolving characters in a much more personal way than I would have as a mere reader.

I also found that my own style had adjusted to the medium. Maybe because of the simple fact that reading from the screen too long is a strain, I knew to keep things short. I also found that I was more likely to mix technology into the story when writing on a computer for people who would read my stuff off another computer screen. Maybe *this* explains why these early efforts inevitably have a science-fiction flavor.

Timely Writer

The implications of these first efforts go far beyond the semi-seriousness of the works themselves. I have learned that, far from making the writing process and its product impersonal, telecommunication lends fiction a certain timeliness and urgency; you'll recall that even in the rather traditional *Blind Pharaoh* Burke Campbell was setting out to create intimacy with his Source readers. But the long-term effects of this electronic publishing process—in which a story may go from the author's mind to the reader's eyes without once taking tangible form—will reveal themselves only gradually. By then the fate of my character in the soap opera will have long been resolved, but right now I'm sitting at the edge of my keyboard. □

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Space Age Computing

Astronaut Sally Ride trusts computers with her life

by Molly Tyson

Sally Ride's life depends on computers—when she's in space, that is.

Sally Ride is an astronaut. With the space shuttle *Challenger's* flight, scheduled for this spring or summer, she will be the first American woman to go into orbit. The five computers that will accompany her and the other crew members help Commander Robert Crippen maneuver the craft in space and literally sustain their life-support systems.

Among other programmed tasks, the computers jettison the booster rockets when the craft reaches an altitude of 28 miles, jettison the fuel tank at 68 miles, and monitor thrust throughout the 8-minute ascent. If thrust exceeds 3gs, the computers will throttle the main engines to save the space shuttle from self-destruction. The computers translate Crippen's maneuvers, indicated via a control stick, into commands the orbiter can understand. In the living quarters, the computers monitor the air, water, cabin pressure, and all the other systems that keep the astronauts alive and get them into orbit and down again safely.

Given this utter dependence on computers in space, Sally and her husband, astronaut Steve Hawley, not surprisingly, decided to get to know one on a more personal basis. They bought an Apple III, which they

Molly Tyson is a freelance writer living in Menlo Park, California.

Photograph by Harry Benson

depend on for much of their entertainment. Sally, a mission specialist with a PhD in physics, says her favorite computer pastime is a game called Zork.

"Zork is going to drive me to my knees," says Sally, who has survived the nausea of zero-gravity simulations and such NASA-inflicted hazards as parachute training and a survival course in barracuda-infested waters. "Zork is deadly," she says. "It takes 35 to 40 hours to play. You're in this underground cavern, there's a dead body here, a dagger there, you kill people off, they kill you. I never come close to winning."

Another one of her favorites is Air Traffic Control. "If a certain number of planes crash under your control, you lose the game," Sally summarizes. "But it's okay to crash one or two small ones."

Sally is also partial to Flight Simulator. "The fun starts when you press W for War," Sally says. "Suddenly you're a World War I flying ace in your Sopwith Camel." It's hard to imagine the appeal of this game because Sally has a private pilot's license and spends at least 15 hours a month traveling near the speed of sound in the back seat of one of NASA's two-seat training jets.

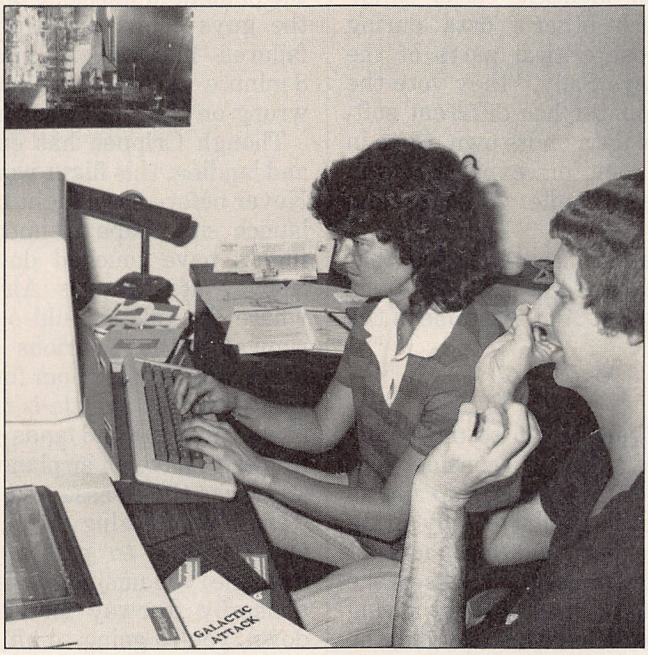
When she can pull herself away from Zork, she enjoys programming, which she learned 15 years ago using punched cards on an old IBM. "We learned FORTRAN and machine language and we wrote programs that told the printer to draw Snoopy on his doghouse," Sally recalls. "That's the kind of class it was."

In graduate school at Stanford University she put computers to better use: processing the data for her thesis on the interaction of X rays with the interstellar medium. She wrote a program that allowed her to feed spectral data (obtained from satellites) into an equation that expressed her theory about the composition of the interstellar medium.

Once she'd completed her calculations, she used a word-processing program and a friend's microcomputer to write her thesis. By this time she'd been accepted into the astronaut program and was in a hurry to finish her paper. She looked upon the computer as a godsend—once she learned about making backup copies. "I erased chapter one by pressing the wrong key," she says. "It's easy to do. After that I kept five copies of the disk with my thesis on it."

Though she hasn't had much time to pursue her own physics research since joining the space program, Sally likes to play with graphics. "I wrote a program that shows nitrogen flowing through an orbiter schematic. It's pretty neat," she says. "Valves open and close."

Not to be outdone, Steve, a mission specialist with a PhD in astronomy, wrote a hurricane-tracking program. "The newspaper published a map that you could cut out and save and plot hurricanes on during hurricane season," Steve recalls. "I thought, shoot, I could draw a map and let the computer plot the hurricane's course. It was a good excuse to learn graphics." Steve learned to program when he was a junior at the University of Kansas. "I was an astronomy major and computers were really making their presence felt in research astronomy," he says. "I loved programming," Steve says. "I loved the challenge of being logical." Nevertheless, it was Sally who wanted to invest in a home computer.



Sally Ride and Steve Hawley at home with their Apple III.

Steve and Sally have put their programming experience to practical use. They've written programs to prepare their income tax, balance their checkbooks, and catalog Sally's stamp collection. "We wrote the programs partly for the challenge," Sally says, "and partly because we were too cheap to buy them." The only store-bought programs they own are Visicalc and some games.

"I wouldn't spend money on anything I thought I could program," Steve says. "My experience with the Apple has been that I get more satisfaction and fun out of programming than I do out of using the programs I write. Like the hurricane program—I wrote it to see if I could do graphics. I wrote the checkbook program to see if I could teach the computer to sort. I

Photograph by Molly Tyson

wrote the home-finance program to see if I could figure out disk I/O."

Programming is not a requisite to being an astronaut, of course. The onboard computers are menu-driven and programmed months ahead of each flight. "There are over 100 different displays we can call up," Sally says, "and each display has a menu of options. If we need to dump extra fuel before an emergency landing, we call up the appropriate display, push a button, and the computer software figures out exactly how to dump it."

Considering Sally's experience with the lost thesis chapter, it's comforting to know that backups are built into the shuttle's computer system. Four of the five onboard computers perform identical tasks simultaneously and compare each other's data during launch and landing—the most critical parts of the flight. "If they disagree," says Sally, "they vote the bad guy out." The fifth computer has different software and processes the same data on its own. Once in orbit, one of the computers monitors experiments in the cargo bay while others handle guidance and navigation.

The onboard computers are so sophisticated that they can land the shuttle without the pilots. But the pilots can't land the shuttle without at least one of the computers.

Tossed in Space

Why have the computers been given so much control? The reason becomes clear when you consider that the orbiter has to function both as a spaceship and an airplane. When it's in space, it maneuvers by firing little jets. When it's in the earth's atmosphere, it maneuvers by moving its aerosurfaces. Thanks to the computer interface, the pilot can manipulate the control stick the same way regardless of his altitude; the computers check the altitude, velocity, and angle of attack, and they determine whether to use jets, surfaces, or some combination of the two to get around in space.

"If you command a pitch when you're about to land, the computer moves the elevons on the wing like an airplane," Sally explains. "If you're in orbit, it fires jets and doesn't move the surfaces at all. The computer is smart enough to know exactly where you are. At different altitudes different things happen. All you do is say you want to maneuver and let the computer worry about how to do it."

It's easy for the pilots to accept their dependence on computers because the computers' role is invisible. "As far as the pilot's concerned, he's flying the airplane," says Sally. "He's got the stick and when he says roll, it rolls."

Bob Crippen, who took the first shuttle into orbit two years ago, will be manning the stick again on Sally's flight. The rest of his crew (Sally, Rick Hauck, John Fabian, and Norm Thaggard) are greenhorns, but they'll feel like old hands after spending hours in the computer-driven shuttle simulator. "Being in the simulator is just like being in the orbiter," Sally says. "They can tilt it so you're on your back like you would be at launch. They can shake it so it vibrates like the shuttle will vibrate during launch, and there's a screen that shows you what you'll see out the window during launch. The computers in the simulator work just like the onboard computers will work, so you get feedback for any input you make. The only difference between the simulated missions and the actual mission is that the guys controlling the simulator throw 10 to 12 failures—like loss of a main engine—at us during one 8-minute ascent. You hope nothing like that goes wrong on the real mission."

Though Crippen has experienced a shuttle launch and landing, this flight won't be without firsts for him. Never before has a flight been scheduled to land at the launch site, Cape Kennedy in Florida. All previous flights have touched down on the spacious desert runway at Edwards Air Force Base in California where the pilots could overshoot or undershoot the runway without serious consequences. At Kennedy there will be less room for error.

Landing the shuttle is tricky because while it looks like an airplane and lands on a runway like an airplane, it doesn't have an airplane's engine. "It has no power, and lacks the finesse of a real glider," Sally explains. "There's no easing down, looking the situation over, and deciding to pull up for another pass, if, for example, you misjudge the aircraft's speed or mistake a nearby freeway for the runway. Once you start down, you're going to hit, and you'd better make the best of it."

"It's unlikely you'd miss your landing site by much anyway. You've got a lot of help," explains pilot astronaut Dave Walker. "You've got the onboard computers telling you when to start your de-orbit burn. You've got the computers down below and all the people who programmed those computers watching to make sure you do it at the right time."

There are several ways for Crippen and pilot Rick Hauck to simulate the shuttle landing before the real thing. In addition to the room simulator, there's an airplane called the Shuttle Training Aircraft (STA) that can simulate the shuttle's flight characteristics. Using reverse thrust, direct lift control, and side force generators, a computer onboard the STA makes the airplane fly like the shuttle.

Just as the pilots have computer simulations to give

them a feel for what it's like to launch and land the orbiter, mission specialists have a simulator to give them a feel for what it's like to use the 50-foot mechanical arm, known as the remote manipulator system (RMS), that enables them to lift satellites out of the cargo bay and place them in orbit.

The RMS, which resembles a telephone pole with joints, has the same complex range of motions as the human arm. It has a shoulder joint that can move up and down (pitch) and side to side (yaw); an elbow joint that moves up and down; and a wrist joint that moves up and down, side to side, and rotates around itself (roll).

"You can move the arm one joint at a time, all the joints in concert, or in computerized auto mode," Sally says. "The problem with auto mode is that it sends the grapple fixture on the end of the arm from point A to point B in a straight line and if that straight line happens to go through a wing, you're in trouble."

A nationally ranked tennis player in her teens, Sally has confidence in her hand-eye coordination. But putting a tennis ball in the center of a racket is child's play compared to putting the end of a 50-foot arm over a tiny probe on a multimillion-dollar communications satellite.

Controlling the yaw, pitch, and roll of the arm's three joints takes a lot of practice. The mission specialists can't practice manipulating the arm itself because it was designed to work in weightlessness. On earth it can't even lift its own weight. So they practice with a computer simulation. In addition to the computer simulation of the arm, Sally worked with a hydraulic arm, a beefed-up version of the RMS. Even the hydraulic arm can't lift a satellite, so Sally practiced lifting helium balloons in and out of a mock-up of the cargo bay.

While the hydraulic arm doesn't look like the actual arm, it has advantages over the computer simulation. "You get a feel for how big everything is," says Sally. "With the computer simulation, if you drive the arm through a wing or through the crew cabin, you can always try again. If you drive the real arm or the hydraulic arm through the crew cabin you kill yourself."

After a hard day at the astronaut office, simulating loss of main engines, loss of cabin pressure, damaged fuel lines, contaminated water, poorly timed de-orbit burns, and other real-life possibilities, Sally enjoys the fantasy world of Zork where she can escape death by re-booting. Not that Sally or any of the astronauts dwell on the statistics that make their profession one of the riskiest around. As one astronaut put it, "We're not going up there to die, we're dying to go up there." □

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• with terminal pgm	409	289

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Micro-Sci

A2 35T Disk Drive	[5] 479	329

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Premium System: Softcard, 16K RAMcard, Videx Videoterm 80 col. Card, Softswitch, Osborne CP/M User Guide	[5] 695	489

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Videx

Keyboard Enhancer II	149	99
Videoterm w/Soft-Switch	375	239

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WHY PAY MORE?

Computers Rock The Music Business

As their industry suffers its worst slump ever, music professionals are looking to computers for aid and inspiration

by Michael Shore and Larry McClain

"When I was 20," recalls New York composer Douglas Kelley, "I thought that the best music was impulsive, out of control. But now that I'm a few years older, I can appreciate the symmetry and precision of musical masterpieces, both the pop and classical varieties. The microcomputer is perhaps the best tool to date for analyzing musical patterns, and in my opinion there's nothing cold or clinical about this type of 'number crunching.' It's making my music much more imaginative, not robot-like."

Just a few years ago Kelley might have been denounced by the music world as a heretic, but now most of his fellow musicians are shopping for their own com-

Famous jazz keyboardist Herbie Hancock uses the Syntauri keyboard and software to compose on an Apple II.

puters. What used to take weeks (to scrawl all the sheet music for a symphony) or years (to become proficient enough to play a finger-knotting Liszt piano piece) can now be done quickly and flawlessly by computer. "Today's musician doesn't have to be a scribe or a virtuoso," says Kirk Henry, an avid computerist whose rock band recorded for the Warner Brothers label in the early '70s. "Armed with the right software and peripherals, even unschooled pop songwriters can teach themselves how to do complicated arrangements."

While professional musicians sink their savings into light pens and *note-sampling* software (programs that let the user blend the sounds of, say, a barking dog and a tuba), their accountants are also putting personal computers to good use. The folks who mind the bottom line in the once recession-proof music business now need all the computerized graphs and pie charts they can get their hands on: 1982 was the industry's worst year since the mid-1950s. "Spreadsheet software is tailor-made for this business," notes Kelley. "It's my guess that Visicalc figured prominently in decisions by several record companies to cut the retail price of albums in order to sell more units."

Every musical genre has its computer crusaders. At the 1982 National Computer Conference, jazz great Herbie Hancock demonstrated the Alphasyntauri music software on his Apple II system. Peter Nero,

Michael Shore is a New York freelancer who has written for *Omni* and *Home Video*. Larry McClain is a staff writer for *Popular Computing*.

Photograph by David Burnett/Contact

Composer Laurie Spiegel sees computers as an asset to musicians who lack the virtuosity to play what's in their heads.

the easy-listening pianist whose steady popularity dates back two decades, writes his own music programs for the TRS-80 Models I and III.

But star testimonials are only a small part of our report. This kickoff feature reveals that professional musicians buy computers for the same reasons most nonmusicians do—namely, to maximize creativity and profits. We also present an overview of the dedicated music systems on the market today, as well as information about some of the less costly products that can turn *your* personal computer into a music maker. That sets the stage for music lover John Edwards, who grabs the baton on page 104 to review three music software packages for the Apple II, Atari 400/800, and TRS-80 Models I and III.

Saving Money and Irritation

Computers are good medicine for those musicians whose perfectionism gets out of hand in the recording studio. According to producer Jack Douglas, computer editing helped the late John Lennon become less self-critical during the recording of *Double Fantasy*, his last album.

Douglas, who has also produced records for Graham Parker, Aerosmith, and Cheap Trick, tells the story this way: "John was an incredible perfectionist. He once told me that he'd recorded only *one* vocal in the entire Beatle period that fully satisfied him—'Come Together' on the *Abbey Road* album. During the making of *Double Fantasy* in 1980, John would just sit with his head in his hands rejecting take after take. He

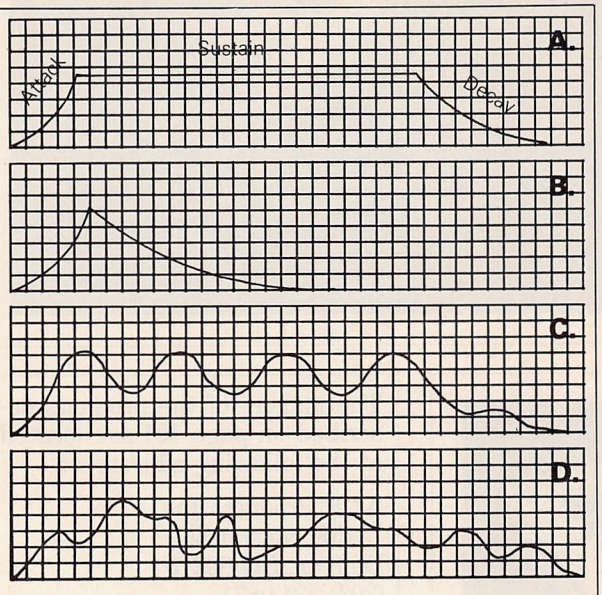
Photograph by Enrico Ferorelli/Wheeler Pictures

What Music Software Lets You Do

You'll be lost without this guide to acoustic terms

Whether you're entering quarter notes and rests into your computer in real time or using a light pen to change the very nature of a musical note, it helps to understand some of the tonal theories first propounded in 1864 by Hermann Helmholtz in *On the Sensations of Tone;* otherwise, terms such as "envelope" and "timbre" mean very little.

What our ears hear as concert A—the note that symphony orchestras worldwide tune to—is really a specific frequency: 440 cycles per second (generally referred to as 440 hertz, or Hz). The lowest frequency on a grand piano, 16.35 Hz, is almost too low to be heard, yet the human ear can appreciate tones much higher than the top note on the piano (4186 Hz). Most people have a hard time discerning frequencies above, say, 15,000 Hz.



A) This graph shows the birth and death of a note played on a pipe organ—the plateau in the envelope is a sustain level (constant volume); B) a transient envelope created by a cymbal; C) the envelope of a note played on a guitar showing periodic tremolo (regularly fluctuating volume); D) an envelope showing random tremolo in a guitar note.

When the lowest F note on the piano is struck, our ears pick up both the note played (the *fundamental*, which determines pitch) and its *overtones* (Fs at higher octaves, which determine the *timbre* or "color" of the note). The reason flutes sound so different from bassoons is that the flute creates a barely perceptible overtone while the bassoon generates a very strong overtone two octaves higher than the fundamental.

The term *envelope* refers to how the volume of a note changes over time (see figure). The *attack* rate is the time it takes for the note to reach its peak volume; *decay* rate is how long it takes for a note to go from peak volume back down to the inaudible level. Most musical instruments attack within 1/100 to 1/10 second. Drums and other percussion instruments attack much more quickly— sometimes within a few thousandths of a second.

Some music systems can display graphs of envelopes on the computer screen. Virtually any type of sound can be analyzed, including those we might not think of as music. In other words, a sound represented on your screen by a parabola probably is *not* a musical note because it has no discernible attack or decay. Some music systems let you change the shape of the envelope with a light pen so that eerie sounds such as a crying baby or creaking door can be given musical properties.

Educators are enthralled by note-sampling systems because students can simply look at the screen to see how the note's envelope is modified by a *tremolo* (fluctuating volume level) or a *sustain* level (constant volume). **—L.M.**

got very frustrated, so I said, 'I'm going to use the computer to merge the best parts from all these takes, and you'll never be able to tell it wasn't a great one-take performance.'

"And John said, 'Aw, go on—it's impossible,' so I did the computer editing in about 10 minutes. He couldn't believe it. He stopped sulking and then did something that was really rare in a Lennon mixing session—he smiled!"

Peter Gabriel, former lead singer with Genesis, Britain's most commercially successful band, feels that studio computers are a boon to fussy musicians who have squandered many hours trying to create sounds that can now be punched up in seconds. "If you look at the liner notes for my album *Security*," says Gabriel, "you'll see references to special effects such as breaking glass and scraping pavement stones in addition to marimbas, saxophones, and so on. We got those exotic sounds on an Australian computer called the Fairlight, which allows the musician to take sounds stored on a floppy disk and play them back in a myriad of ways. You can modify the original sound so that it becomes rather spooky and unearthly."

But what about the "unearthly" price tags on dedicated music systems? Many professional musicians see them as an investment. "Some groups are willing to pay $15,000 and up for dedicated systems," says Douglas Kelley, "because they can work out complex arrangements and nuances at home rather than

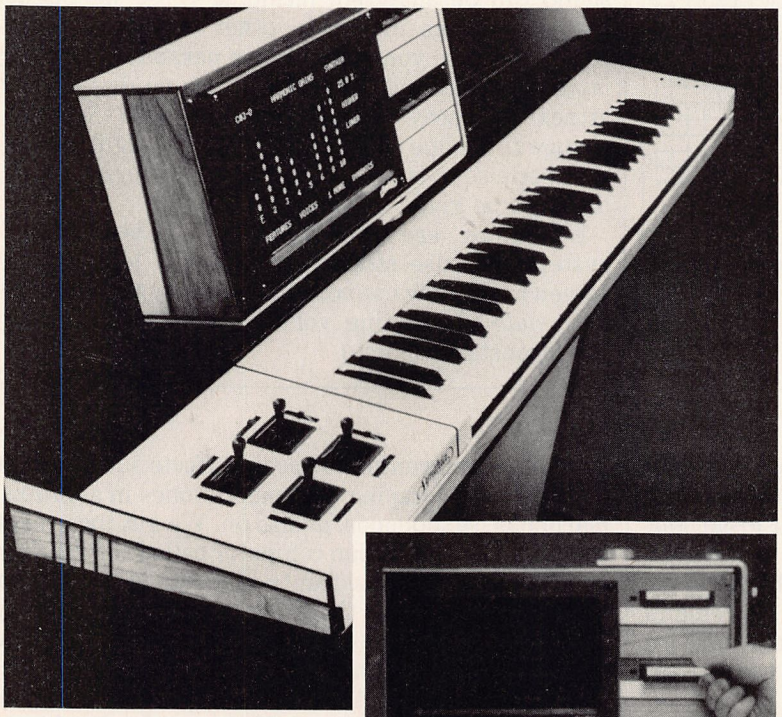
CONTINUED ON PAGE 102

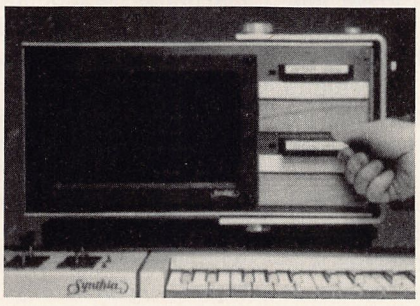
Chart courtesy of Adaptive Systems Inc.

Harmonious Hardware

Finding the music system to match your budget

By adding a DEC VT-1000 terminal (above), users see graphs of sounds created on Synclavier II (right).





Adaptive Systems' Synthia offers a lot more than analog synthesizers in the same price range. Data storage is on cassette (right).

The makers of the products described on page 101 are located at the following addresses:

ALF Products Inc.
1315F Nelson St.
Denver, CO 80215
(303) 234-0871

Passport Designs Inc.
116 North Cabrillo Highway
Half Moon Bay, CA 94019
(415) 726-0280

Syntauri Corporation
Suite 112
4962 El Camino Real
Los Altos, CA 94022
(415) 966-1273

Adaptive Systems Inc.
POB 9356
Newark, DE 19714
(302) 366-0478

New England Digital Corp.
POB 546
White River Junction, VT 05001
(802) 295-5800

Okay, so maybe you don't have what it takes to be a symphony conductor. Perhaps you're still financially overextended after buying that personal computer in the first place. That doesn't mean, however, that you're barred from making music with your microcomputer. This section will give you a sampling of the products on the market—from the surprisingly entertaining music-synthesizer cards that retail for under $200 all the way to those $25,000 music systems that even Leonard Bernstein would be hard-pressed to criticize.

We'll look at the three major categories of music hardware/software: coded-entry systems, keyboard entry instruments, and dedicated music systems.

Coded-Entry Systems

Virtually all the products that consist of a music-synthesizer card and allied software rely on game paddles or alphanumeric keyboards for entering musical notation. The Orchestra-90 package for the TRS-80 calls for the user to enter alphanumeric characters that are then compiled by the computer. No musical staff, notes, or rests appear on the display screen, a limitation that makes editing and debugging a real chore.

The MC1 music synthesizer for the Apple II and IIe ($195) from ALF Products Inc. consists of a synthesizer card (which interfaces the computer to your stereo system for high-fidelity output) and software. When MC1 is booted, you'll see two musical staffs for bass and treble clef displayed on the screen; notes and rests are entered via the game paddles. Because MC1 notation isn't entered in real time, you must use numbers to specify such things as tempo, sustain, attack, and decay rates.

Real-Time (Keyboard-Entry) Systems

These music makers consist of four- or five-octave keyboards and software designed to run on popular microcomputers (primarily the Apple II). The friendliest feature of the real-time system is its piano-key note entry (also found on the dedicated systems). It's a case of what you see is what you get, because no sooner do you hit middle C on the keyboard than it appears in its familiar spot on the musical staff displayed on the screen. Based on the time signature you've entered into memory, the notes automatically break into measures.

Soundchaser Digital from Passport Designs Inc. is a real-time music synthesizer for the Apple II and IIe (48K-byte memory and one disk drive required). For roughly $1250 you get a four-octave keyboard, synthesizer card, and Notewriter software that enables you to make changes and deletions in your music.

Syntauri Corporation makes five real-time music synthesizers for the Apple II. The basic components include keyboard and software ($700 for the four-octave, $1200 for five-octave), Apple II interface ($30), and cable ($35). Optional software includes Musicmaster, a $150 music-theory tutorial, and Draw Waves, a $30 package that lets the musician create and modify note envelopes. Syntauri's newest software offering (Composer's Assistant, $295) makes it possible to generate hard copies of the music displayed on your screen. Many popular printers will work with Composer's Assistant, including the Epson MX-80.

Dedicated Music Systems

The word "dedicated" is your first tip that these are computers designed to be music systems and *nothing but* music systems. Your rank-and-file computerist is likely to look at these high-priced digital synthesizers and cry, "I think I'll buy that Mercedes after all!" But many serious musicians wouldn't part with their dedicated systems any more than word-processing purists would part with their Wang 30s.

The Synthia from Adaptive Systems Inc. is an eight-voice system with touch-sensitive display that retails for $28,600. It packs two tape (not disk) drives with 256K-byte RAM (random-access memory) capacity. Notes are entered on the 61-note musical keyboard. The niftiest thing about Synthia is its ability to do *interpolative* programming. This means that you can program the lowest C as a viola and the highest C as a piccolo and, during a run up the keyboard, the sound makes a smooth transition from one instrument to the other.

The Synclavier II from New England Digital hauls down honors for most space-age keyboard among the digital synthesizers. It provides LED (light-emitting diode) readouts of hertz and decibel levels, allows easy, one-stroke transposition from one key to another, and has a double-command erase button to prevent accidental erasures. The 16-voice, 32K-byte synthesizer can be yours for $19,750. Be forewarned, though, that the peripherals aren't cheap. If you go the whole hog and buy a 5-megabyte Winchester drive, dot-matrix printer, graphics terminal, and suggested software, the bottom line is a sobering $40,225. For its price, Synclavier II gives the musician astonishing control over timbre and note creation. The user can even gawk at high-resolution graphics showing note frequencies in three dimensions.

Even though it's possible to purchase more than 5700 record albums for the same amount of money you'd spend on the top-of-the-line Synclavier II system, professional musicians who test-drive such systems wind up as awestruck as kids in a candy store. Bill Mauchly is a Pennsylvania recording engineer and musician who recently said, "For the first time, the computer is an instrument, not a glorified music box." Mauchly is no Johnny-come-lately on the computing scene, either. His father was John W. Mauchly, one of the inventors of ENIAC, the world's first patented computer.

running up astronomical tabs in the recording studio. After all, it costs you $125 an hour in leading studios in New York and Los Angeles."

But many musicians refuse to sink thousands of dollars into dedicated music systems when even ordinary Apples and TRS-80s can be programmed to speed up complex tasks like arranging. Pianist/arranger Peter Nero explains it this way: "I use nearly 400 scores in my concerts with symphonies around the country. I use the TRS-80 to keep track of score changes, where scores have been sent, and when they've been returned. It's a tremendous aid."

New York session musician Ed Walsh has used computers on projects ranging from albums (Pointer Sisters, Bette Midler) to TV commercials (music for Club Med, Kentucky Fried Chicken, and Dr. Pepper spots) to television themes. Last fall, Walsh and composer Dave Grusin became a two-man (digital) band to record the theme for NBC's hospital series *St. Elsewhere*. "If you listen to that theme, it certainly sounds like more than two guys playing," says Walsh. "I guess that's the scary thing about the systems that make creation and storage so easy—they really can gobble up jobs. It's a legitimate worry for horn and string players, and as a session man I can relate to those concerns. The idea of one man at a keyboard doing the work of an entire orchestra is going to be very attractive to a lot of the people controlling the purse strings in this business."

Producer Russ Titelman is no technophobe, but he asserts that studio computers save time and money only in theory, not in practice. "The studio computer is here to stay, but it makes the producer a prisoner in a sense," claims Titelman, who supervised Randy Newman's acclaimed album *Trouble In Paradise*. "The computer allows me to do with relative ease what George Martin and The Beatles had to strain to accomplish back in 1967, but it also takes a lot of the fun out of things. If the artist isn't a perfectionist, then the producer is likely to be, so you keep using the computer for those tiny updates. It still takes us about the same length of time to record and mix an album."

Controlling Needles and Itineraries

While musicians get all the press and the platinum albums, the behind-the-scenes players are turning to computers too. Stew Romaine, a mastering engineer for CBS Records in New York, uses a machine called the Discomputer 3900A to complete the delicate transfer of the recording artist's music onto an aluminum master, which is then used to make the thousands of vinyl LPs sold in stores. It's a process, says Romaine, that drove many engineers to drink back in the days before digital technology.

"Have you ever wondered why records made in the '60s had only 16 minutes of music per side?" queries Romaine. "Back then you could go crazy trying to control the lathe that cuts the grooves on the master. You see, every time a rock band changes the dynamics abruptly—goes from very soft to very loud—the lathe digs a wider groove. Before the advent of computers, the mastering engineer had no idea when the dynamics were about to change. That's why the Discomputer is so valuable. The computer previews the signal a split second before it goes from tape to cutting lathe and adjusts the lathe to make optimum use of the 'real estate' on the master. That's how I was able to get 24 minutes per side on Elvis Costello's *Get Happy!* album, something unheard of even a few years ago."

According to Romaine, computers are also helping to eliminate the skips and imperfections that have irritated record lovers for more than half a century. "The Discomputer helps me make masters that are about 60 times less likely to skip or stick than the ones made just 10 years ago."

Booking agents and managers are discovering that computers are worth their weight in dog-eared copies of music trade papers like *Billboard* and *Cash Box*. "My manager thinks that Adam Osborne is the greatest genius since Paul McCartney," chimes Kelley. "He's even trying his hand at writing some scheduling software for CP/M."

Peter Nero uses the TRS-80 Model I to store and retrieve data about concert halls; it reminds him of acoustic quirks, seating capacities, and repertoire played on the last visit. "The computer lets me plan an itinerary two years into the future," he says. "That's roughly 600 concert dates."

They're Not for Dilettantes

Houston-based songwriter David Huberman feels that the public picked up a lot of wrongheaded notions about synthesizers during the 1970s. "I went to an electronics show about 10 years ago," he recounts, "where some guy demonstrating a synthesizer played the hit song 'Dueling Banjos,' then twirled a few knobs and played 'Dueling Bagpipes' and 'Dueling Trumpets' and more. This sort of performance led many people to think that the synthesizer was just an instrument for rich dilettantes. The scientists who synthesized that little five-note ditty in *Close Encounters of the Third Kind* didn't help matters, either. That's why it's so difficult to convince people today that music synthesizers are useful."

Of course, no one is accusing today's Top 40 synthesizer aces of being dilettantes. According to British journalist Ray Hammond, there are weeks when more than half the records in the British Top 10 feature music composed and performed on microprocessor-based instruments. Computer-enhanced music could well turn out to be the biggest thing to hit the music business since Beatlemania. "Computers demystify the music-making process," says pop star Peter Gabriel. "The revolutionary thing about these digital instruments is that they make ideas more important than technique." □

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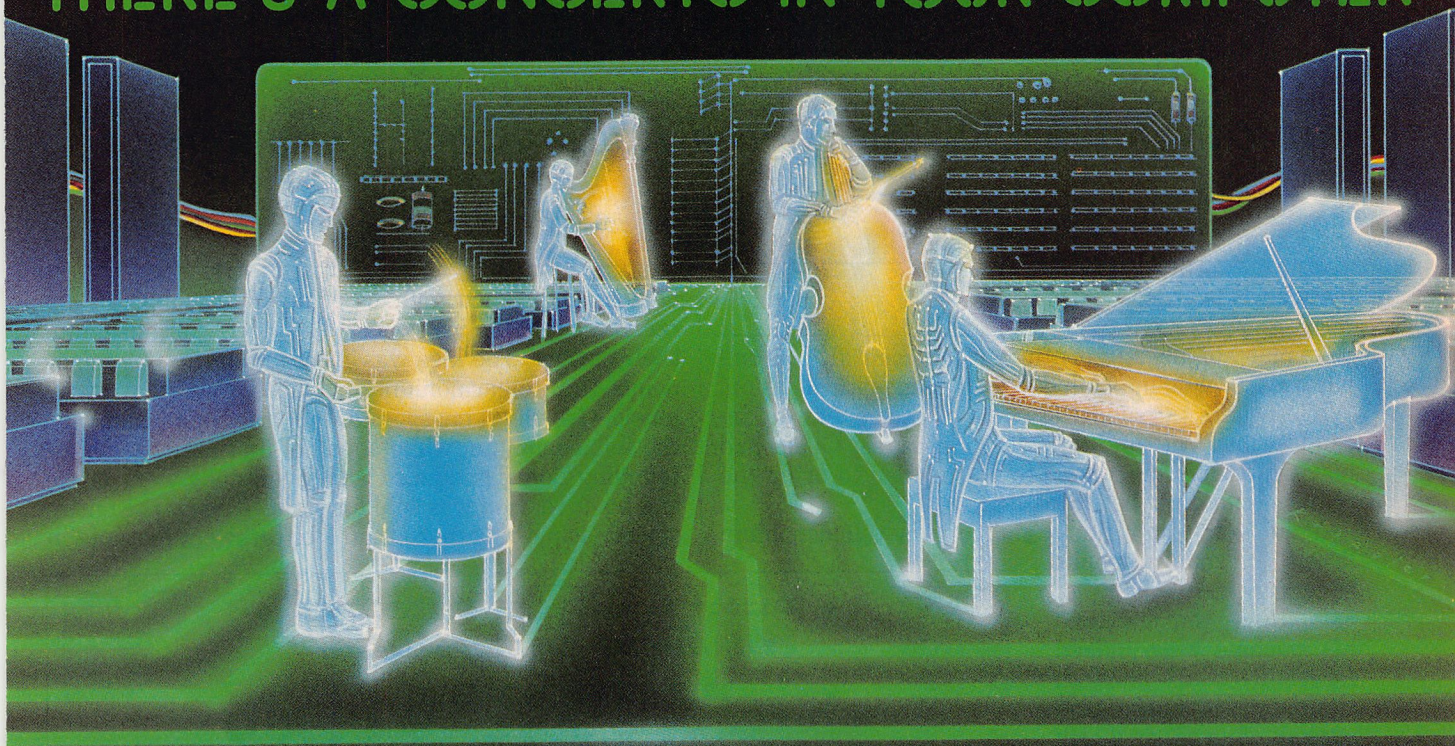
THERE'S A CONCERTO IN YOUR COMPUTER



COMPU-MUSIC

... And a waltz, a blues song, a rhapsody, and a whole lotta rock n roll. In fact, your computer can now play any kind of music, thanks to the new Roland Compu-Music.

Roland, the world's leading producer of synthesizers and electronic musical instruments, has put its years of music programming experience into a high performance computer/music synthesizer system that can easily be used by anyone—from the computer-user with a musical background to the programmer with a song in his heart.

The Roland Compu-Music does for music what the word processor has done for words. The Compu-Music software allows your computer to write, program, change and store musical compositions of up to eight voices, plus a seven voice electronic drummer. The Compu-Music hardware (CMU-800) is a music synthesizer that plays these musical parts.

The CMU-800 connects to your computer through any auxiliary slot and then connecting to any amplifier or stereo system for performance. Because the Compu-Music system is software based, it allows for virtually infinite hardware expansion. It can never become obsolete.

Playing and programming the Compu-Music is so easy that you don't have to be a musician, but if you are, you'll appreciate the well-thought-out programming, a system that Roland has used for many years with proven success. Also, the CMU-800 hardware easily interfaces with many other synthesizers for expanded performance—all controlled by your computer.

The Roland CMU-800 Synthesizer retails for $495.00. The Compu-Music Software retails for $70.00 and is available for the Apple II and NEC computers. For more information, see your computer dealer or contact: RolandCorp US, 2401 Saybrook Avenue, Los Angeles, CA 90040 (213) 685-5141.

Roland

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Software for Apple, Atari, and Radio Shack computers

by John Edwards

Like many of his nineteenth-century scientific contemporaries, Thaddeus Cahill was a man with a vision. While others pursued the goals of steam power, incandescent light, and horseless carriages, Cahill had his own dream. He longed to be the man to bring the telharmonium to the world.

While you won't find Cahill or his telharmonium listed in many books covering the history of computing, the man and his machine were indeed forerunners of modern computerized music—precursors of an age in which electronic music can be found in everything from television commercials to arcade games. The story of Cahill and his machine is both fascinating and tragic.

Developed in 1896, the telharmonium was a far cry from today's modern computers. In fact, the immense size of the machine may be difficult to comprehend. By the time it was completed and moved on several railroad cars to its permanent home in New York, the instrument weighed over 200 tons. Its massive size indicates the amount of intricate machinery that was needed to make the telharmonium work. Its "sound generators" were primitive electrical alternators that depended upon a series of pulleys, gears, and drive motors. The device was controlled by two performers situated at a mammoth keyboard. Indeed, the entire machine was so noisy as it worked that it had to be located in a building separate from its listeners.

The idea behind the telharmonium was to sell music produced by the machine to subscribers via telegraph wires (sort of like the way Compuserve, The Source, and cable TV operate today). The enterprise's stockholders envisioned millions of people rushing to buy receivers and dialing concerts of electrical music into their parlors. The idea was great except for one minor point—the telharmonium produced perfectly awful music. Growling, bassy, and definitely unharmonious, the telharmonium, while ahead of its time, was an astounding flop. Thaddeus Cahill eventually went broke and his invention was sold for scrap. Today, the entire episode is nothing more than a bittersweet footnote in the history of machine-made music.

Fanciful facsimile of an 1896 ad for the telharmonium—electronic music's biggest flop

Electronic music has obviously made great strides since Cahill's day. Computer software enables even the nonmusician to learn how to compose and arrange acceptable music. Because microcomputers have the ability to "learn" music at any speed and then play it back in real time, users can absorb music theory very quickly.

Atari, Apple, and TRS-80 users are particularly lucky when it comes to the availability of music-making systems: synthesizers that are both reasonably priced and fun to use are available for all three computers.

Although the packages reviewed here aren't serious

John Edwards, a freelance writer based in New York, contributes frequently to *Popular Computing*.

Advertising art by T.J. Lyons Press

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WORD CHALLENGE
The Ultimate Word Game

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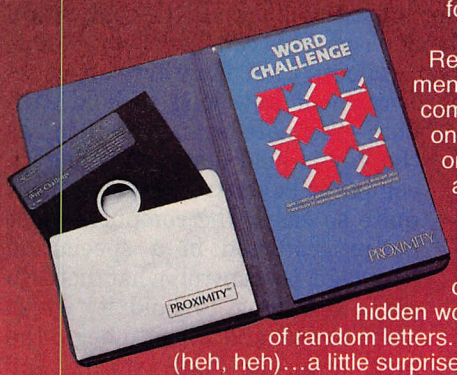

Ready for some mental gymnastics, computer style? Take on Word Challenge,™ one of the most advanced, intelligent software game programs available. The object: locate the hidden words in a square of random letters. The competition: (heh, heh)...a little surprise from the programmers—LEX, an opponent of uncannily human intelligence. Word Challenge generates the game board (note the sample square, with 166 hidden words) and you race the clock with LEX to see who finds the most words. Naturally LEX knows that the longer the word, the better the points. So while you might enter "bar," "ant" and "den," LEX is picking out "abrase," "resented" and "serene," all part of his remarkable 90,000-word vocabulary. But don't give up hope. If LEX seems a little too formidable at first, you can give him a sort of electronic lobotomy by selecting from his 26 different playing levels. You can also choose the square size, time limit and a variety of scoring methods.

Word Challenge is a fast, entertaining and educational game that'll provide hours of fun for the whole family. It's great as a teaching tool for building vocabulary, spelling and problem-solving skills.

To master the Word Challenge, take a mere $39.95 to your nearest personal computer dealer. For Mastercard and Visa orders, call toll-free, **1-800-323-0023**. In Florida, call collect, 305/566-3511. Or complete the coupon and send your check or money order for $39.95 (plus $2.00 shipping and handling) to: Word Challenge, Proximity Software, 3511 N.E. 22nd Avenue, Fort Lauderdale, Florida 33308.

Please send _____ Word Challenge Disk(s) for which I've enclosed $39.95 each (plus $2.00 shipping and handling) Florida residents please add 5% sales tax.

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- ☐ IBM Personal Computer (min 64k) w/disk drive
- ☐ Osborne I or II (min 64k) w/disk drive

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PROXIMITY™

competition for dedicated music systems like the Synthia and Synclavier II, they're excellent teaching tools. And the sounds you'll be able to create are far more euphonious than the ear-splitting dirges created by Thaddeus Cahill's telharmonium 80 years ago.

At a Glance

Name: Orchestra-90

Use
Music composition, arrangement, and performance

Manufacturer
Software Affair
858 Rubis Dr.
Sunnyvale, CA 94087

Price
$149.95

Format
5¼-inch floppy disk or tape cassette plus plug-in interface board

Computer
TRS-80 Model III, 16K bytes of RAM

Documentation
43-page loose-leaf insert and demonstration disk

Audience
People interested in composing, arranging, and performing music on personal computers

Orchestra-90

Of the three systems tested for this article, the Orchestra-90 package for the Radio Shack TRS-80 Model III (a Model I version is also available) is certainly the most sophisticated music synthesizer. At $150, it's also the most expensive. In the case of this software, however, the old adage about getting what you pay for may actually be right. The Orchestra-90 package offers a stereo synthesizer with a six-octave range, the capability of playing five simultaneous notes ("voices"), as many as five timbre settings for each voice, and a full-screen text editor that allows you to insert, delete, and add data with great flexibility.

The secret behind many of these impressive features is an interface board that plugs into the Model III's integral input/output bus. Besides music-making hardware, the board has sockets for interfacing the computer with a stereo system. Because Orchestra-90 outputs through your home stereo, the package's music sounds quite impressive. TRS-80 users who remember Radio Shack's attempt at a music synthesizer that output audio through the computer's cassette port will marvel at the system's range of rich tones. In terms of the sound produced, Orchestra-90 can actually be compared to a dedicated music synthesizer.

Not true performing tools, these low-cost packages are great teaching aids.

Composition

The major problem facing the user of any inexpensive computer system comes when it's time to input the musical instructions. Because conventional microcomputers are not equipped with a piano-style keyboard, methods for inputting music via the computer's keyboard must be devised. This can lead to problems. For instance, a pianist doesn't have to worry about actually telling the instrument how long to hold each note—the note sounds as long as the key is held down. "Playing" a computer keyboard, however, isn't quite so easy. The computer must be programmed in a specialized language to control what note to play, how long to hold it, which voice to use, and when to begin the next note. In other words, you don't actually play the piece, you teach your computer to play it. When in its playback mode, Orchestra-90 and other microcomputer synthesizers do all the work. You just sit back and soak in the sound.

The heart of Orchestra-90 is its music language compiler, a system that turns musical symbols into the symbols used by the computer. The compiler will accept music written in any key or time signature and in any pitch within the synthesizer's range of whole notes to sixty-fourth notes. Notes may be single, double, or triple dotted or played as triplets. The computer understands accidentals (instructions to ignore a key's sharps and flats) and can also handle repeats and modulation (using melodic or chord progressions to gradually change key). With all of this power, it should come as no surprise to learn that this system cannot be mastered in a few days.

Documentation

Orchestra-90's documentation, like the system itself, is very impressive. Consisting of 43 loose-leaf pages that can be placed in a binder, the instructions cover just about every level of the program's use. Clearly written and well organized, the instructions should meet the requirements of beginning and advanced users alike. Orchestra-90's demonstration disk (or cassette) teaches the user how to construct melodies.

An interesting adjunct to the Orchestra-90 program is its ability to run musical files downloaded from online databases. Any TRS-80 Model I or III user equipped with a telephone modem and communications software can access a wide range of popular and classic songs merely by dialing a telephone number and loading the desired files to disk.

For Orchestra-90 owners with Compuserve accounts, files can be accessed by entering "R PHOTOS" after logging on. Other musical files are available by dialing the Message-80 bulletin board in Haledon, New Jersey (201-790-6795).

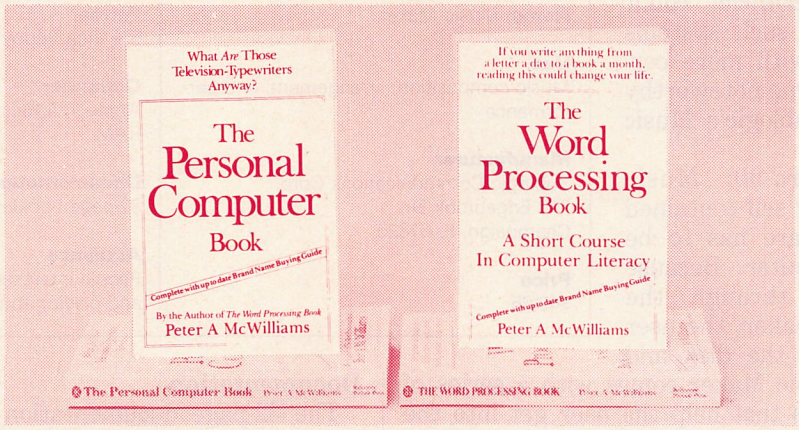
Both Compuserve and Message-80 maintain dozens of selections covering the entire spectrum of musical

Time: "A beacon of simplicity, sanity and humor. The fastest selling computer guide on the market."

Newsweek: "These sprightly, clear, funny primers explain everything you need to know."

The New York Times: "Solid advice for the first-time buyer. Just what the consumer needs."

The Wall Street Journal: "Mr. McWilliams manages to demystify, and he is genuinely funny to boot."



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Chicago Sun Times: "At last, computer reading that's fun. There is no more engaging, readable and sensible writer on the subject than McWilliams."

All Things Considered: "Pleasant and reassuring."

TV Guide: "Among many books on computers that are now available, the two by Peter McWilliams are especially useful."

Philadelphia Inquirer: "By far the best seller in the field, with cause. McWilliams is truly witty on a bewildering subject."

Ben Fong-Torres: "For all of us who are taking our first queasy steps into this high-tech jungle, Peter McWilliams is an authoritative yet easy-going guide. Simply put, he has written the best computer books around."

The Detroit Free Press: "Thorough, lucid, helpful, and a lot of fun."

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Philadelphia Daily News: "A refreshing change from the ponderous, heavy and fear-inspiring tomes that dominate the field."

Dallas Morning News: "One of the best things about this book, aside from sound advice on selecting a personal computer, is McWilliams' name-brand buying guide."

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Peter A McWilliams is a nationally syndicated columnist on personal computers.
His work has appeared in Playboy and other publications.

tastes. Some of the songs offered recently include "Cocktails for Two," "The Impossible Dream," "Tangerine," and the theme from *The Addams Family* TV series.

Music Maker

Music synthesizers for the Apple II seem to be an industry unto themselves. An unofficial count shows at least six such systems already available, with more certainly on the way. One noteworthy recent arrival is Sublogic's Music Maker.

Unlike Orchestra-90, Music Maker is an entirely self-contained package—no hardware has to be added to the computer. Because sound is output through the Apple's internal speaker, the user has simply to boot the disk and compose away. Music Maker comes with a series of demonstration tunes that help the user get into the swing of things from the very start.

Composing and arranging with Music Maker is much simpler than with Orchestra-90. Unfortunately, this simplicity also means that the system isn't as flexible as its TRS-80 counterpart, nor does it sound as good. Among the limitations are the package's 1000-note limit (beyond which songs have to be chained together) and its inability to "color" voices to imitate specific instruments. On the other hand, the casual user will appreciate not having to learn a complicated composition language—songs can be entered and played back within minutes. Music Maker is a program that most users can master in a few days.

At a Glance

Name: Music Maker

Use
Music composition, arrangement, and performance

Manufacturer
Sublogic Communications Corp.
713 Edgebrook Dr.
Champaign, IL 61820

Price
$49.95

Format
5¼-inch floppy disk

Computer
Apple II, II Plus, and IIe, 48K bytes of RAM

Documentation
32-page booklet

Audience
People interested in composing, arranging, and playing music on personal computers

Composition

Entering notes and other musical values into Music Maker is quick and uncomplicated. Information for each voice is entered line by line into a program-like listing that scrolls by as the song is played. While technically only a single-voice system, Music Maker can create a multiple-voice effect by rapidly alternating a series of separate notes, blending them together and producing the effect of a chord. Compared to Orchestra-90, it's a clumsy system, but it works quite well after the user has sufficient practice on it.

Music Maker can handle most types of musical notation. Notes and rests range from whole notes all the way down to 256th notes. Sharps, flats, and naturals are all possible, as are dotted notes, staccatos, and legatos (smooth passages). Missing is the ability to tie notes together. Such notes have to be simulated by entering the value as a single note (for example, one half note takes the place of two tied quarter notes). But don't think of this as a drawback; it's a minor inconvenience compared to Beethoven's messy quills.

Documentation

The 32-page documentation booklet supplied with Music Maker is generally excellent. In addition to doing a fine job of explaining the system, the booklet also takes the user through the actual development of several sample songs. The booklet also features a very thorough section on how to use the system's modules in a wide range of applications programs. While such information is probably too technical for the average user, it's nice to see that Sublogic hasn't overlooked the serious hacker.

Music Composer

The Atari Music Composer is a cartridge-based system that enables the user of any Atari 400 or 800 to compose and arrange music to be played back over a television's internal speaker.

Considering the Atari computers' sophisticated sound capabilities, Music Composer turns out to be something of a disappointment. While the system handles just about all forms of musical notation (no

At a Glance

Name: Music Composer

Use
Music composition, arrangement, and performance

Manufacturer
Atari Inc.
1265 Borregas Ave.
Sunnyvale, CA 94086

Price
$59.95

Format
ROM cartridge

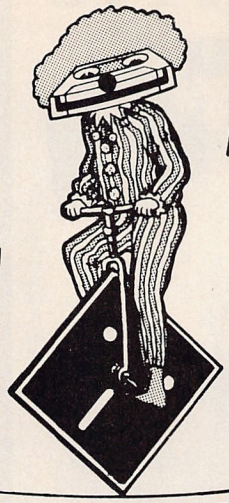
Computer
Atari 400 and 800, 16K bytes of RAM

Documentation
21-page booklet

Audience
People interested in composing, arranging, and playing music on personal computers

TRS-80
MODEL I
MODEL III

In the center ring . . .



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triplets, though), the fact that it plays through a television speaker (a device seldom hailed for the quality of its sound) hurts the system. Also, while the system has four separate voices, they all have the same timbre. This wouldn't be so bad if the sound didn't resemble something from an organ grinder's hurdy-gurdy (fine for Donovan fans, but monotonous after a while). Indeed, you almost expect to see a little graphic monkey flitting around the screen. Music Composer's audio is hard to tolerate from a company that regularly boasts about its computers' sound.

Composition

While Music Composer doesn't produce very good sound, it does possess the easiest method of notation entry of the three systems examined. What helps make the system so easy is a series of well-designed menus and a display that graphically depicts each note entered on a pair of musical staffs. While in the performance mode, the program highlights notes as they are played. These touches are perfect for youngsters just getting a start in music theory.

To enter music into Music Composer, you must give the computer several pieces of information one note at a time. You must tell it the name of the note (or rest), whether it has an accidental, and which octave the note is in (Music Composer has a rather limited three-octave range). In addition, you can control such factors as tempo, key signature, and meter. These are entered from a separate menu and can be changed at any time before or after composition. Users with 16K bytes of random-access memory can enter over 6000 notes before files have to be linked together for playback.

Arranging

One of Music Composer's most powerful features is its ability to instantly arrange any music that has been entered into it. By calling up the arrange menu, you can handle chores such as key transposition. You merely select "Transpose" from the menu and indicate the number of half steps you wish to raise or lower the music. Music Composer will then automatically make the change and alter any accidentals. Other commands are carried out with equal ease.

Documentation

Atari hasn't always had a sterling record of supplying adequate documentation with its computers and software, so I was pleased to discover that Music Composer's instructions are really quite clear. While the system's 21-page booklet doesn't delve deeply into technical material, it does give you a good idea of what you're up against. One weak point of the documentation, though, is its spotty coverage of the fundamentals of music. The booklet assumes that you know all about chromatics and time signatures, so purchasing an elementary music textbook to go along with the system probably wouldn't be a bad idea. □

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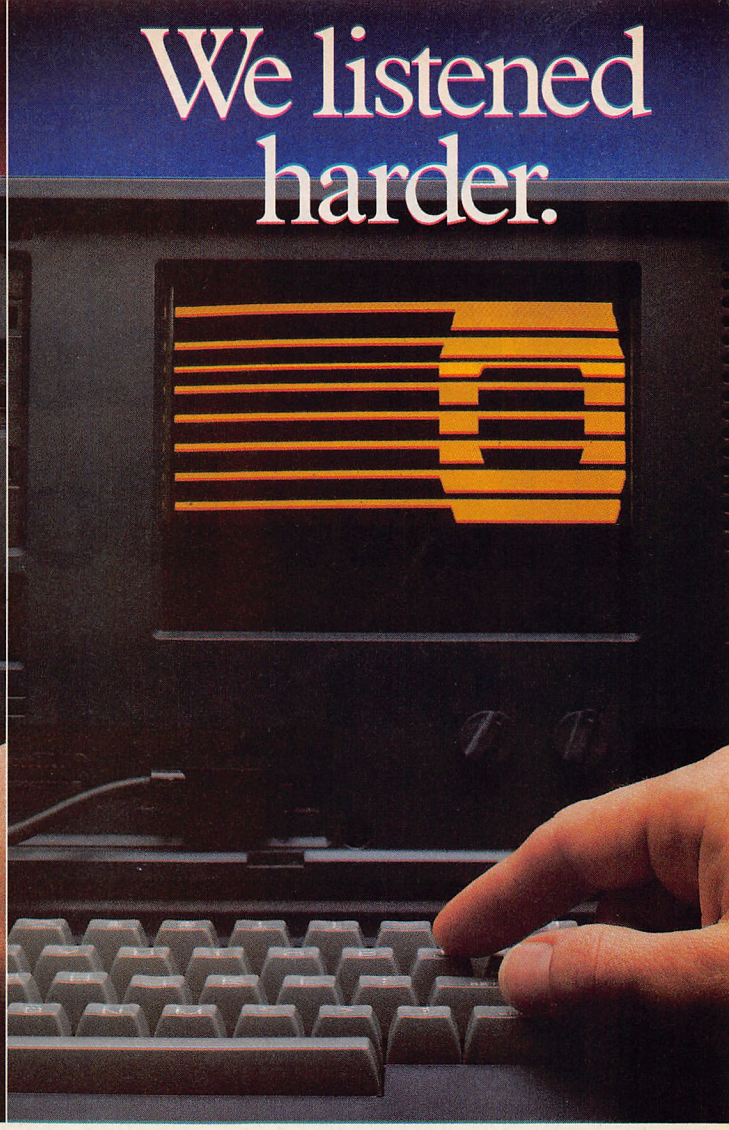

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The Super Spreadsheets: How Do They Compare?

A feature-by-feature evaluation of Visicalc, Visicalc Advanced Version, Multiplan, and Supercalc

by Barbara E. and John F. McMullen

If you're an experienced Visicalc user, you've probably developed a "Visicalc wish list"—a list of features that you wish Visicalc included. Visicalc Advanced Version will significantly reduce your list. At $400, Advanced Version contains all the features, functions, and formulas that Visicalc has, as well as increased power and sophistication.

Visicorp, the company that markets both packages, is not phasing out the original Visicalc in preference for Advanced Version and will continue to offer both products. Advanced Version is designed for those who like Visicalc and have mastered it but have found limitations in the program. These shortcomings include the inability to easily center labels in a column, the lack of an internal rate-of-return function, the inability to format reports, and other features that are corrected in Advanced Version (see the table on page 122 for a complete list of Advanced Version's commands and functions).

Advanced Version is also directed toward new users who recognize the need for a tool more sophisticated than basic Visicalc. On the other hand, some users will not feel that the additional features justify the $150 price difference and will stick with the basic version. (If you already have Visicalc, you may upgrade to Advanced Version for $200.) Advanced Version is currently available for the Apple III and may be available for the IBM Personal Computer by the time you read this review. Visicorp has not announced any plans to make the program available for other computers.

To put Visicalc Advanced Version into proper perspective, we've compared it not only to Visicalc but to two other spreadsheets that we feel are or will be the most widely used: Supercalc, distributed by Sorcim, and Multiplan, produced by Microsoft Corporation. In November 1982 Sorcim announced Supercalc II, an upgraded version of Supercalc that is impressively more powerful than its predecessor. Throughout this article, we refer to the original Supercalc, not to Supercalc II, which should be on the market by the time you read this.

We have also come up with our own Visicalc wish list and show how these other spreadsheets or third-party add-ons to the basic version of Visicalc make our

Barbara E. and John F. McMullen run a computer consulting business in New York City.

PROGRAM	APPLE II	APPLE III	IBM PC	PRICE
VISICALC	YES	YES	YES[1]	$250
Visicorp, 2895 Zanker Rd., San Jose, CA 95134, (408) 946-9000				
VISICALC Advanced Version	NO	YES	by mid-1983	$400
Visicorp, 2895 Zanker Rd., San Jose, CA 95134, (408) 946-9000				
MULTIPLAN	YES	YES[2]	YES[3]	$275
Microsoft Corp., 10700 Northup Way, Bellevue, WA 98004, (206) 828-8080				
SUPERCALC	YES[4]	YES[5]	YES	$295
Sorcim, 2310 Lundy Ave., San Jose, CA 95131, (408) 942-1727				

The Best-Selling Spreadsheet Programs and the Computers They Run On

wishes come true (see the chart on page 114). In addition, we've reviewed the availability of these spreadsheets for the Apple II (the most commonly used computer at present for Visicalc and Visicalc-related products), the Apple III, and the IBM Personal Computer (see the chart above).

A Short History

In May 1979 Visicorp (then called Personal Software) introduced Visicalc for the Apple II for $100. About a year later, the company released the program for other machines such as the TRS-80. Visicalc quickly became the most popular software product in history (Visicalc in its later iterations continues to be so).

But as people grew more and more dependent on Visicalc, they suddenly became chronic complainers. Where Visicalc was once the greatest, most indispensable decision support tool in history, almost overnight it was "plagued" with "limitations." But Visicalc hadn't changed. Its users had simply progressed to the next level of dissatisfaction. People recognized the potential of microcomputer tools and demanded to know why Visicalc didn't have all the features they wanted.

Visicorp responded with an improved version of its original product. The upgrade also coincided with a hardware change made by Apple, which had upgraded its disk drives from 13-sector to 16-sector drives. Companies formatted all new software for the new hardware, and software manufacturers modified popular old software and reissued it to operate directly on the new hardware. The second version of Visicalc sold for $150 (owners of the first version could buy the upgrade at a reduced price). The price has since increased for most computers to $250.

The upgraded version of Visicalc included some major enhancements, among which were the Boolean or logic functions (IF, OR, AND, NOT, ISERROR, ISNA, TRUE, FALSE, NA, ERROR), the Edit command, an orderly exit, DIF, and a vastly improved manual. The Boolean functions enabled you to say in one Visicalc statement such things as "if an employee

NOTES: (1) as both an IBM and Visicorp product; (2) under CP/M which requires additional equipment for Apple III; (3) as both an IBM and Microsoft product; (4) with additional hardware for CP/M; (5) under CP/M which requires additional equipment for Apple III

Special effects by MB Productions

A VISICALC WISH LIST

The following items are some of the most commonly sought enhancements to the basic version of Visicalc. In some cases, the computer needs additional or different hardware for a particular capability. (Many limitations due directly to Apple II constraints no longer exist in either the Apple III or the IBM Personal Computer. For example, Visicalc will utilize whatever native memory is made available to it. With a 64K-byte Apple II, you have 34K bytes available for model building, while Visicalc resides in the remaining 30K bytes of memory. With additional hardware—Saturn expansion memory cards and software, for instance—you can use up to 177K bytes for model building on the Apple II. On the Apple III with its expanded memory, you have 179K bytes of the machine's 256K bytes for model building. On the IBM PC, you also can take advantage of the machine's expanded memory. Both Supercalc and Multiplan are limited to 64K bytes of memory.) In other cases, software provides a solution; in the chart below, we've noted one of the more popular programs.

WISH	VISICALC	VISICALC ADVANCED VERSION	MULTIPLAN	SUPERCALC
VARIABLE SIZE COLUMN WIDTH	NO[1]	YES	YES	YES
SCREEN FORMATTING CAPABILITIES SUCH AS:				
—Centering labels and values in a column	NO	YES	YES	NO
—Decimal alignment	NO	YES	YES	NO
—Using $, CR, DR, % signs with values	NO	YES	$, % only	NO
SORTING OF ROWS	NO[2]	NO	YES[3]	NO
REPORT FORMATTING	NO[4]	YES	YES	NO
INTERNAL RATE-OF-RETURN FUNCTION	NO	YES	NO[5]	NO
THE ABILITY TO CONSOLIDATE LIKE MODELS	YES[6]	YES[7]	NO[8]	NO
AUTOMATIC DOWNLOADING OF DATA FROM TIMESHARING SERVICES INTO MODEL	NO[9]	NO[10]	NO	NO

NOTES: (1) except on reports with Visicaids program for the Apple II; (2) except with Versacalc program from Aurora Systems; (3) 255 rows; (4) except for various mediocre add-on programs; (5) however, a formula is provided; (6) DIF techniques only (except with the Visiblend program from Microlab for the Apple II); (7) DIF techniques only; (8) except for file-linking techniques; (9) except with Context Connector add-on program from Context Management for the Apple II or with Visilink add-on program from Visicorp; (10) except with Visilink add-on program from Visicorp

works overtime (more than eight hours in a day), a particular column will contain his overtime wages (time and a half for all hours over eight hours)." These functions also enabled you to flag all entries that met certain criteria (for example, sales more than $1000 per month and expenses less than $200 per month).

The Edit command allowed you to correct errors in long and complex formulas rather than retyping them completely. The orderly exit enabled you to go on to other programs without having to turn your computer off and on again. DIF (Data Interchange Format) techniques enabled you to transfer your Visicalc data to other software products (particularly other Visicorp products such as Visitrend/Visiplot, Visifile, and so on). The new manual set a standard for most of the manuals we now see. It contained both a tutorial and a separate reference guide (the previous Visicalc manual tried to be both and succeeded as neither.

Yet with the second version of Visicalc came a whole new set of perceived limitations. The most dramatic was that suddenly the computer was simply too small. The original Visicalc ran on an Apple II with 32K or 48K bytes of memory (and later on 64K-byte systems when the Apple language card was introduced). The revised Visicalc required a minimum of 48K bytes, and when used on a 48K-byte system, it allocated only 18K bytes for user models compared with 25K bytes that the original version allocated. (Because of a technical quirk, the user space in a 64K-byte system declined only from 35K to 34K bytes).

The 18K-byte space provided for user models proved to be much too constraining for most applications and forced most users to expand their systems to 64K bytes. Furthermore, the new features in the revised version allowed for much more complex models which, in turn, required more memory. Hence, many users found even the 64K-byte systems too small. The industry responded to this need for more user work space by developing the necessary devices and programs for expansion. Most notable was the response from Saturn Systems, the first company to develop both the hardware and software that enabled Visicalc to use memory above 64K bytes (up to 128K bytes additional). It was through similar hardware and software changes that many of the complaints people had about Visicalc were eliminated on the Apple II.

Many of the limitations people perceived in Visicalc were in fact limitations of the Apple II, and as the program migrated to other computers, these problems disappeared. For example, the 40-character display and the 34K-byte user capacity on the Apple II became 80 characters and 179K bytes on the Apple III (with even greater memory capacity on the IBM Personal Computer).

Supercalc and Multiplan

As various companies responded with Visicalc add-ons, altogether new products were emerging that claimed to satisfy a Visicalc wish list better than Visicalc with third-party add-ons. One of these products was Supercalc, which was made available first for the Osborne 1 and later for the Apple II (operating under CP/M, which requires additional hardware such as a Z80 card and usually an 80-column screen card) and the IBM Personal Computer. Supercalc does such nice things as display all your formulas on the screen, let you specify individual column widths, provide data-protection capabilities, display help text any time in a command or data-entry sequence, and allow partial worksheet loading.

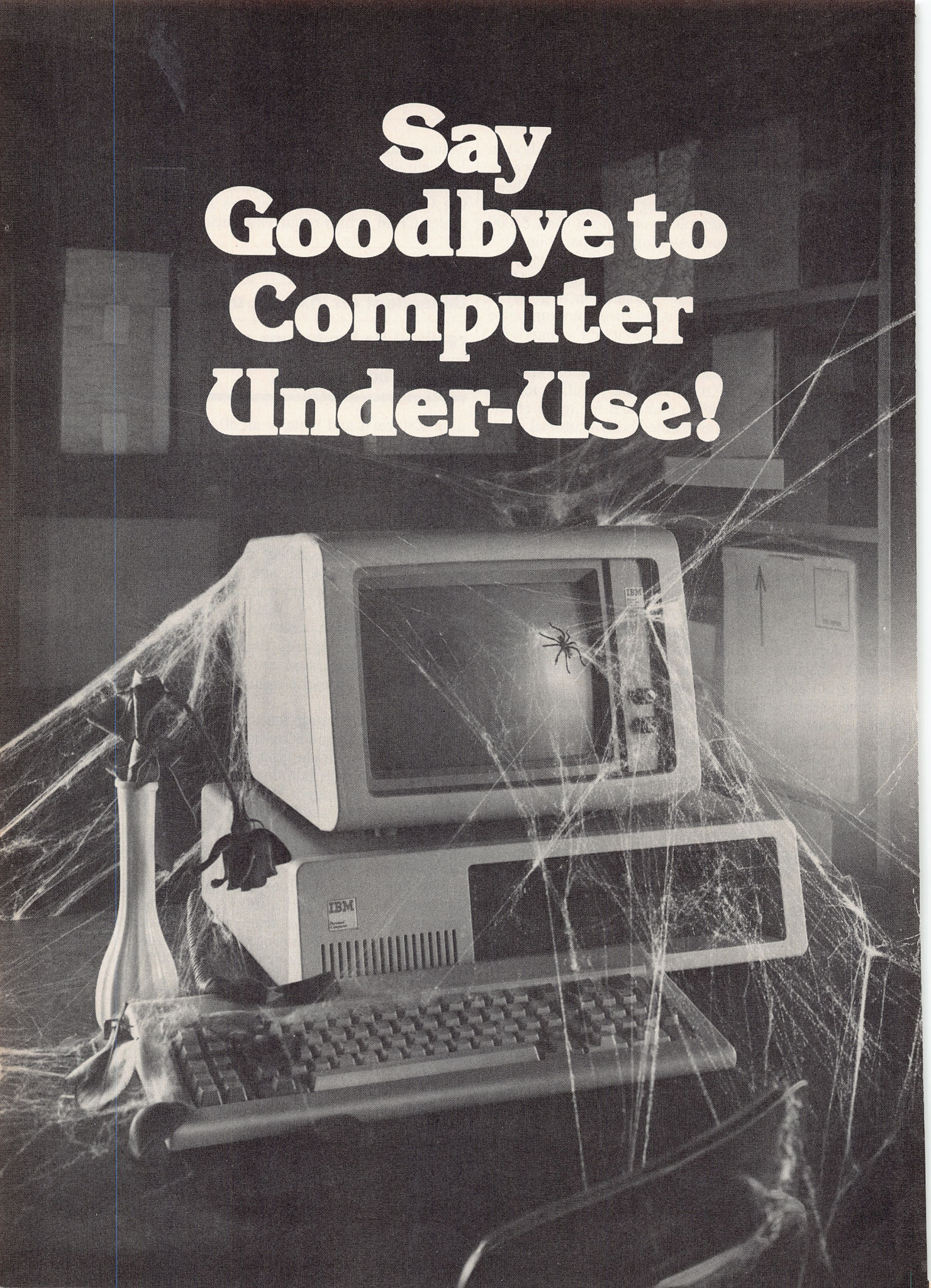
As people grew more and more dependent on Visicalc, they also realized its limitations and became chronic complainers.

Multiplan, a spreadsheet distributed by Microsoft, runs on the Apple II and III and the IBM PC. Multiplan contains every one of the formatting and calculating functions of Visicalc and Supercalc—and more. It includes the ability to center numbers or text within a column, specify decimal accuracy, calculate standard deviation, sort up to 255 entries in a column, and create up to eight separate display windows on the screen.

A particularly handy feature of Multiplan is its ability to name cells and then use the names in formulas. Suppose, for example, you listed the prices for your products in column B under the column heading Price. In column C you might have the quantity sold of each product with the heading Quantity. Then in Column D you could key in the formula "= Price * Quantity" and title that column Amount (which you could then use in subsequent formulas).

Multiplan also provides increased capabilities for formatting reports and a linking ability that enables you to use information from various worksheets on other worksheets. The program provides for only 64K bytes of working memory on an IBM PC which, even with the program's linking capability, seems restrictive.

All the characteristics we've mentioned distinguish one spreadsheet from another and should give you a general feeling for each product. However, depending on the computer you have, you'll get more or fewer of a spreadsheet's features. Before purchasing a spreadsheet, examine the documentation for your hardware to make sure you can get the features you want. For example, until recently Visicalc was not upgraded for the TRS-80 Model II; before this upgrade, you would not have had Visicalc's logic functions with that particular hardware.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Visicalc Advanced Version

Unlike any of the other spreadsheets, Visicalc Advanced Version was first announced for the Apple III. It requires a minimum 128K-byte memory, a built-in disk drive, and either a hard disk or at least one external drive. Hard disks, in our opinion, are the wave of the future, and it's valuable to have a version of Visicalc that operates on a hard disk. Advanced Version works beautifully with the Apple Profile hard disk, which gives you greater speed in all your disk-handling routines (such as saving and loading models) and enables you to store large spreadsheets more easily.

No matter what the promotional materials say, learning to use a spreadsheet program requires a significant investment of your time.

The advantages of hard-disk storage become immediately obvious when you start using the spreadsheet. As spreadsheets became more sophisticated, the programs became too large to reside wholly in memory at any one time and still provide users with a reasonable amount of memory for their own use. To correct the problem, the programs called subsystems into memory as required from the disk, and this meant slower systems. Advanced Version also uses this technique to provide its new features, and when operating the program with a floppy disk, we experienced the slowness of 5¼-inch disk drives. But the dramatic improvement in speed when operating the program with the Profile hard disk was instantly apparent. In fact, those who use a Profile hard disk will scarcely notice the constant disk access.

Probably the most visible and important advantage of Advanced Version over any of the other spreadsheets discussed here is that it is still Visicalc—with, once again, improvements. No matter what the promotional materials say, learning to use a spreadsheet requires a significant investment of your time. While it takes less time to learn a second spreadsheet, it takes time nonetheless. If you're already using Visicalc, you'd probably prefer to continue to use Visicalc than to start with another spreadsheet. When you load Advanced Version into the computer, what you see looks just like Visicalc, and when you depress the slash key (/) for command mode, you see the familiar command menu at the top. In fact, you can choose to use only the portion of the system that you're already familiar with. As your needs grow and as time permits, you can pick up the program's additional commands and functions.

The program's other major selling point is that if you have an Apple III and need more power than Visicalc, then Advanced Version is the only product currently available in the native Apple III mode (Supercalc and Multiplan have CP/M versions that should run with the new Apple III CP/M system, but you'll need additional equipment). Let's look now at some of Advanced Version's more important enhancements in some detail.

Attributes

In Advanced Version, the Attribute command sets formatting characteristics for individual cells. This long-awaited command is nonexistent in Visicalc, and consequently, it isn't difficult to pick out documents created with Visicalc. They are stripped down models—just the facts—with no embellishments such as commas in numbers to separate thousands and dollar signs. Formatting in Advanced Version is comprehensive, although to some it may not seem as flexible as the formatting in other spreadsheets.

Visicalc traditionally allows you to affect either a single cell or the entire matrix (globally). Intermediate steps, such as those affecting one column or 10 rows, must be done through replication. In contrast, Supercalc offers the ability to format cells individually, by row, by column, by blocks, or globally without being overly complicated. Multiplan also provides this capability.

However, we feel that two other considerations are more important: first, the number of formatting options provided, and second, the ease of using these options. Visicalc Advanced Version offers the greatest number of formatting options. It handles labels and values independently and includes left alignment, right alignment, spacing between the left or right edges of a cell, and end of the label or value. It provides plus and minus signs, minus signs only for negative numbers, negative numbers displayed in parentheses, debit symbols (DR) or credit symbols (CR), and commas appearing every three digits in numbers with four or more digits to the left of the decimal. With Advanced Version you can display the decimal point whether or not any digits are to the right of the decimal point, suppress all trailing zeros, and multiply values by 100 and display them with a percent sign or dollar sign. You can also display values in fixed format with the specified number of digits after the decimal point or display values in integer form, scientific notation, or graph form.

Advanced Version also allows you to select multiple formats. It features the Format command as we know it in Visicalc but with an impressive addition: the ability to assign complex formats a single-character name that you can then invoke for any cell simply by typing /F and the character assigned to the format. You can specify up to 37 formats and include any of the other attributes available in the system: the ability to display formulas in cells, make the contents of a cell invisible, define whether or not data can be entered in a

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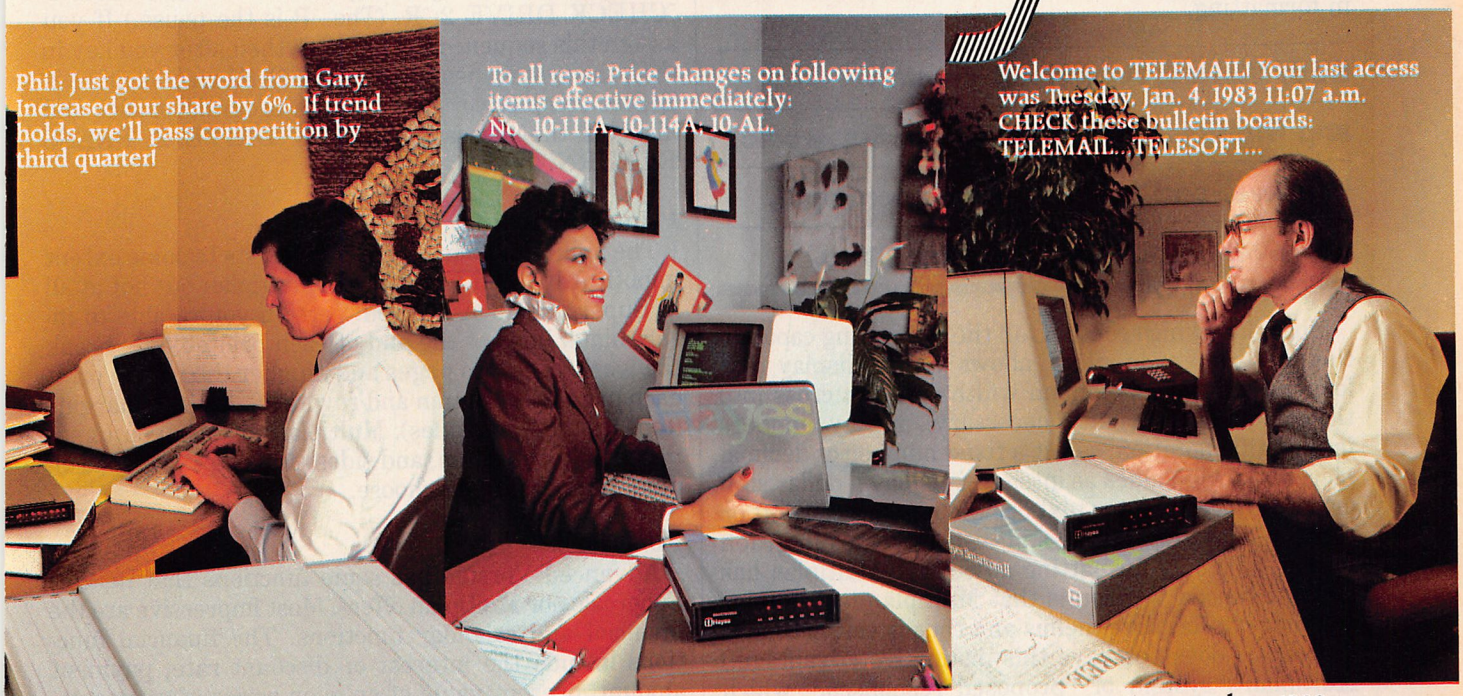

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cell and what kind of data (labels, values, or numbers) can be entered, and set tabs in a cell. Advanced Version's Attribute command combined with this user-defined Format command provides exceptional power in formatting.

Both Visicalc Advanced Version and Multiplan offer more than Supercalc in power and friendliness. Supercalc II, however, should prove competitive.

Multiplan, which contains all the formatting capabilities that Supercalc offers, allows you to display text longer than the full column width (you can cross into the column on the right if necessary), display numbers in scientific notation, select a fixed number of decimal places, display values as integers, display a dollar sign or percent sign, center text or numbers in a cell, left or right justify a cell entry, and display values in graph format. The only formatting advantage Multiplan has over Advanced Version is that Multiplan has simpler and more descriptive menus and thus is easier to use. (Supercalc does not have this distinctive advantage.) Multiplan's system of "proposed responses," which tries to anticipate your choices, also works beautifully. On the other hand, Visicalc's command language, which may be confusing to some users, becomes even more overwhelming in Advanced Version because of the great number of options available.

Keystroke Memory

Keystroke memory is another striking enhancement in Visicalc Advanced Version that's not available in either Multiplan or Supercalc. With this feature you can capture a series of keystrokes—including tabbing forward to the next cell, depressing Return, moving the arrows, asking for help, depressing the Escape key or Ctrl-C, and any commands, functions, text, or values—and then assign the series a one-character name. To invoke the series you simply type /K and the one-character name, and the program executes the sequence for you.

With keystroke memory, you can capture up to 125 keystrokes in a single series, and several examples are shown in the documentation. A series of keystrokes that sends a printer setup string to a Centronics 739 printer is: /PP"^CIK^H1B^H14^CI132N^R. You can assign this string the name A and invoke it at any time by keying /KA.

A series of keystrokes that enters column labels for a monthly budget is: JAN^>FEB^>MAR^>APR^>MAY^>JUN^>JUL^>AUG^>SEP^>OCT^>NOV^>DEC^R. If you assign the name B to the string, you can call it up at any time by keying /KB.

You can also assign pauses and display a message during a pause. For example, to save a worksheet on the disk in drive 2 under the name FILE1, you might have the following assignment: /SS.D2/FILE1^P^CHECK DRIVE 2:^R. (The ^P is the pause.) If you assign this sequence the name C, then after you key in /KC, the system begins to save FILE1 on disk drive 2. Before completing the save, the program pauses and displays the message CHECK DRIVE 2: PRESS RETURN.

Print Formatting

The ability to format printouts exists to some extent in both Advanced Version and Multiplan but not at all in Supercalc. In Advanced Version you're able to insert blank lines at the end of each printed line, break the worksheet into pages and number the pages, print each page with column and row titles, and set margins (top, bottom, and sides). Multiplan enables you to set margins (top, bottom, and sides) and print row and column numbers if you choose.

Functions

Advanced Version has some functions that neither Supercalc nor Multiplan offers. Most impressive are the financial and calendar functions. The financial functions include the interest or discount rate, payment amount, present value of an even series of payments, future value of an even series of payments, internal rate of return based on an initial investment and a range of cash flows, and net present value of a series of even or uneven payments.

The calendar functions perform date arithmetic. You can convert calendar dates to absolute dates, then do arithmetic with the absolute dates and convert the results back to real dates. An absolute date is the number of days between the date you select and a fixed date. The fixed date upon which all absolute date calculations are based is January 1, 1979 (the year Visicalc was introduced). You can also convert hours, minutes, and seconds into fractions of a day and determine the hour, minute, and second portion of the calendar date corresponding to the absolute date given. For example, @HOUR(100.5) returns 12 because 100½ days after January 1, 1979, it was 12 o'clock.

Conclusion

In all, Visicalc Advanced Version is impressive. Of the spreadsheets mentioned, we like it best primarily because of its tremendous power. While it does not have the friendliness of Multiplan, if you've mastered Visicalc, Advanced Version will give you no trouble.

Both Advanced Version and Multiplan offer more than Supercalc in power and friendliness. However, Supercalc II will boast some nice enhancements and should prove competitive. Until we have an opportunity to review Supercalc II in detail, we'll continue to pick Advanced Version as our favorite spreadsheet. □

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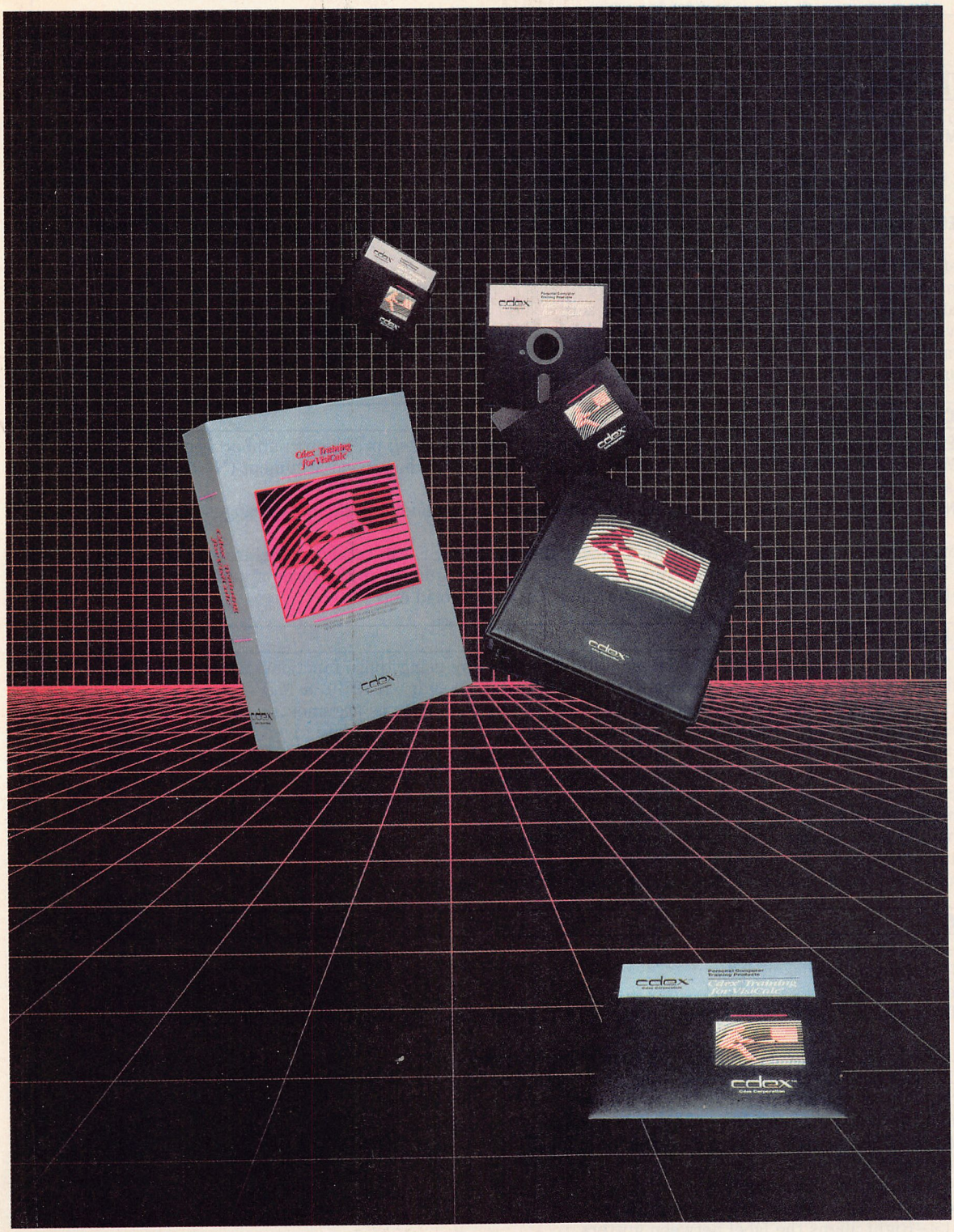

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Commands and Functions Available in Visicalc Advanced Version

FINANCIAL FUNCTIONS*

@ RATE (N, PMT, PV, PV)–Interest or discount rate of the given arguments
@ PERIODS (I, PMT, PV, FV)–Number of periods of the given arguments
@ PMT (I, N, PV, FV)–Amount of each payment of the given arguments
@ PV (I, N, PMT, PV)–Present value of an even series of payments
@ FV (I, N, PMT, VP)–Future value of an even series of payments
@ IRR (INVESTMENT, RANGE)–Internal rate of return based on an initial investment and a range of even or uneven cash flows
N–Number of periods; must be an integer greater than zero
PMT–Payment each period; can be positive or negative
I–Interest rate; must be positive or negative but not zero
PV–Present value of a series of payments; may be positive or negative but not a range
FV–Future value of a series of payments; may be positive or negative but not a range
*The formula used for each function is documented in the manual

ARITHMETIC FUNCTIONS

@ ROUND (V, PRECISION)–Rounding for less precision (V=value you want rounded; precision=number of decimal places)
@ MOD (N, M)–Modulo: the remainder after the first argument is divided by the second argument (N=first argument; M=second argument)
@ DOTPROD (RANGE1, RANGE2)–Dot product multiplies the contents of corresponding cells in two ranges and sums the products
@ LCHOOSE–Works just like the @CHOOSE function except that @CHOOSE can return a label instead of a value
@ LABEL and @ VALUE–@ LABEL returns the expression it takes as its argument in the form of a label; @ VALUE guarantees that a cell reference will return a "true value," not a "hybrid entry"

CALENDAR FUNCTIONS

@ VMDY and @ MDY–You can convert calendar dates to absolute dates by using these functions. An absolute date is the number of days between the date given and a fixed date (Monday, January 1, 1979). @ MDY returns the number of days since the base date of January 1, 1979. @ VMDY takes only real dates as arguments
@ DAY–Returns the day portion of the calendar date corresponding to the absolute date given as the argument
@ MONTH–Returns the month portion of the calendar date corresponding to the absolute date given as the argument
@ YEAR–Returns the year portion of the calendar date corresponding to the absolute date given as the argument
@ HMS–The time functions treat time as a fraction of a 24-hour day counted from midnight. @ HMS converts a time argument (hours, minutes, seconds) into fractions of a day
@ HOUR–Returns the hour portion of the corresponding calendar date
@ MINUTE–Returns the minute portion of the corresponding calendar date
@ SECOND–Returns the second portion of the corresponding calendar date

COMMANDS

ATTRIBUTES (/A)–Sets cell characteristics
EXPRESSION (E)–Displays formulas in cells
HIDE (H)–Makes contents of cells invisible
MODE (M)–Defines whether or not data can be entered in a cell and the kind of data allowed (labels, values, or numbers)
PROTECT CELL (P)–Protects the contents of a cell from being changed
LABELS, VALUES, AND NUMBERS (A)–Allows you to enter all data types
LABELS ONLY (L)–Allows you to enter only labels in a cell
VALUES ONLY (V)–Allows you to enter only values in a cell
NUMBERS ONLY (#)–Allows you to enter only numbers in a cell
TAB (T)–Sets tab in cell
LABEL (L)–Sets label display characteristics
ALIGN LEFT (<) –Left aligns the label between gutters
ALIGN RIGHT (>)–Right aligns the label between gutters
LEFT GUTTER (L)–Determines the number of character spaces between the left edge of the cell and the beginning of the label
RIGHT GUTTER (R)–Determines the number of character spaces between the right edge of the cell and the end of the label
REPEAT CHARACTER (F)–Repeats the label across the column between gutters
CENTER (C)–Centers the label between gutters

VALUE (V)–Sets value display characteristics
- ALIGN LEFT (<)–Left aligns a value between gutters
- ALIGN RIGHT (>)–Right aligns a value between gutters
- LEFT GUTTER (L)–Sets the number of character spaces between the left edge of a cell and the beginning of a value
- RIGHT GUTTER (R)–Sets the number of character spaces between the right edge of a cell and the end of a value
- SHOW SIGN (+ OR -) (+)–Positive values are preceded with a plus sign; negative with a minus sign
- SHOW - SIGN (-)–Negative numbers are preceded with a minus sign; positive numbers and 0 have no sign
- NEGATIVE NUMBERS IN PARENS (()–Negative numbers are displayed in parentheses
- SHOW CR AND DR SYMBOLS (C)–Positive numbers are displayed with the debit symbol (DR); negative with the credit symbol (CR)
- DECIMAL POINT (.)–Displays a decimal point
- COMMAS EVERY THREE DECIMAL PLACES (,)–Commas appear every three digits in numbers with four or more digits to the left of the decimal
- SUPPRESS TRAILING ZEROS (Z)–All trailing zeros are suppressed
- MULTIPLY BY 100 AND SHOW % (%)–Values are multiplied by 100 and displayed with percent sign (%)
- SHOW DOLLAR SIGN ($)–Displays a value with the dollar sign
- GENERAL (G)–General value display
- SPECIFY DISPLAY PRECISION (F)–Values are displayed in fixed format with the specified number of digits after the decimal point
- INTEGER (I)–Displays values in integer form
- SCIENTIFIC NOTATION (S)–Displays values in scientific notation
- STARS (*)–Displays values in graph format

CLEAR (/C)–Irretrievably erases all data on the worksheet and returns the cursor to position A1
- CLEAR SHEET; SAVE CHARACTERISTICS (S)–Clear worksheet entries and attributes; formats, printer settings, and keystroke sequences are retained

DELETE (/D)–Irretrievably erases rows or columns
- DELETE RANGE (SPECIFY RANGE)–Range within row deletes corresponding number of columns; range within column deletes corresponding number of rows

FORMAT (/F)–Controls how an entry is displayed or printed
- REPEAT LABEL (-)–Repeats label characters across a cell (like /–)
- USER-DEFINED FORMAT (=)–Allows you to use a letter or shifted number to stand for a complex format that you specify with the options of the Attribute command (up to 37 formats)

GLOBAL (/G)–Affects the entire display in any one window
- ATTRIBUTES (A)–Assigns the specified attributes to each cell on the worksheet that has no local attributes
- COLUMN WIDTH (C(INT))–Single-column-width option sets the width of all cells in a column (from 1 to 125 characters)

HELP–Displays screens of text to help you with various topics as you work

INSERT (/I)–Adds blank rows or columns to the worksheet
- RANGE–Range within rows inserts corresponding number of columns; range within columns inserts corresponding number or rows

KEYSTROKE MEMORY SEQUENCE (/K)–Lets you create a one-character abbreviation for keystroke sequences. Instead of retyping a long series of keystrokes, /K captures the keystrokes in memory and lets you give them a one-character name

MOVE (/M)–Moves rows or columns to another position on the worksheet
- FROM/TO RANGE–Specifies a range of rows or columns to be moved

PRINT (/P)–Produces an image of the worksheet just as it appears on the screen
- LINE FEED (L)–Inserts a blank line at the end of every printed line
- PAGE BREAK (B)–Breaks worksheet into pages
- PRINT TITLES (T)–Prints column and row titles on each page of the worksheet
- PAGE NUMBERS (#)–Numbers each page of the worksheet
- PAGE LENGTH (P)–Numbers of lines of text to be printed on each page
- PAGE WIDTH (W)–Width in characters of each page
- PAPER LENGTH (F)–Length in lines of a page
- LEFT MARGIN (M)–Left margin in characters

REPLICATE (/R)–Copies a value, label, formula, blank entry, or local format
- ATTRIBUTES ONLY (A)–Replicates attributes or format only; cell contents are not replicated
- CELL CONTENTS ONLY (C)–Replicates cell contents only; attributes are not replicated

CA
CO

by Rachael Wrege

If you're looking for a new career or thinking of switching from an old one, you probably know better than to aim toward the recession-ravaged housing or steel industries. In fact, if you're like most American job hunters, you're looking for a job that can withstand current economic hard times and keep you productively employed for years.

Considering the computer industry is a smart move. Despite last year's recessionary economy, widespread layoffs, and slowed hiring trends, the computer field is still the hottest job market around—and one that's more likely than other industries to stave off the specter of future unemployment.

In this guide to the computer job market, we'll take a look at what happened to the industry in 1982 and identify trends for 1983. We'll examine typical job descriptions and salaries and forecast the job outlook for the next decade. We'll see which jobs are on the rise and which are on the way out, how to get the training you'll need, and where to look for the job that's right for you.

The backbone of the computer industry includes computer manufacturers, software houses, retailers, and vendors. Not to be overlooked, however, are the related fields of data processing, manufacture of computer supplies, and computer-oriented publishing. The range of jobs is really much wider than it might at first appear to be.

1982: The Recession Hits

While the computer industry in general has been

Illustrated by Scott MacNeill

REERS IN VIPUTING

growing rapidly for the past five years, 1982's recession took its toll, creating frightening layoffs and sluggish hiring trends. U.S. Department of Labor statistics for 1982 show that unemployment in the computer industry went from 7.1 percent in May to 13.1 percent in November. Massive layoffs dealt the infant industry its first real blow—Burroughs Corporation laid off 4000 workers, for example, and Texas Instruments added another 6450 to the growing lines of the nation's unemployed.

Until 1982, virtually anyone with some computer experience in programming, management, operations, or clerical work could find a job in the industry. With the recession, hiring slowed down and personnel recruiting changed significantly, according to a report by Dunhill Personnel System Inc., a national employment firm with headquarters in New York.

Despite last year's recession, the computer field is likely to stave off future unemployment.

Businesses involved in large-scale data processing, such as banks and insurance companies, did most of the hiring last year, the Dunhill report reveals. The year before, these businesses had accounted for about half of the hiring in the industry; in 1982, they accounted for over 70 percent. The report also indicates that people who found computer-related jobs in 1982 had more experience, were hired into upper-level jobs, and were expected to have people-oriented skills. Most employers, says Dunhill, were far more selective in their hiring practices than ever before.

Salaries increased more slowly in 1982, according to a report produced by Source EDP, a national personnel agency. The average salary for beginning programmers rose only 4 percent from 1981 levels, and salaries for managers of large data-processing departments increased by only 6 percent.

1983: A Rosier Outlook

Despite the recession's impact on the computer industry, most observers expect the field to sustain a certain level of growth simply because the increased productivity and cost savings that computer technology creates are essential to business in the current belt-tightening economy. According to Standard and Poor's Industry Surveys published in October 1982, the business microcomputer market is expected to increase at a compounded annual growth rate of 40 percent through 1986, leading the entire office equipment industry.

Through 1986, the minicomputer market is expected to grow at an annual rate of 20 percent, with mainframe sales increasing by 7 percent. The computer services industry is expected to grow at an annual compounded rate of 23 percent, reaching $53 billion in yearly revenues by 1986. Software sales, now the smallest part of the computer services industry, should grow at an annual rate of 33 percent.

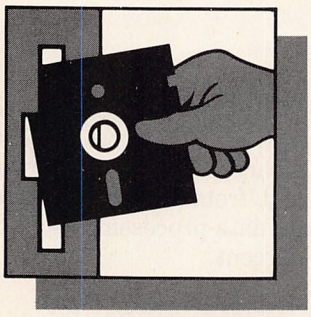
Rachael Wrege is West Coast editor of *Popular Computing*.

What do all these statistics mean? Simply that more computers will be in use and that the number of computer-related jobs will be on the rise. While some 1.5 million people were involved in the computer industry in 1980, says the U.S. Bureau of Labor Statistics, by 1990 that number should reach 2 million—a 33 percent increase.

A Sampling of Computer Careers

Job titles in computing, as in any other industry, vary tremendously. The same job title means different things at different firms. Programmers in smaller companies may be responsible for both programming and systems analysis, while in large firms they may be relegated to one specific type of programming. In this section we'll look at some of the many careers in computing and see what they generally entail.

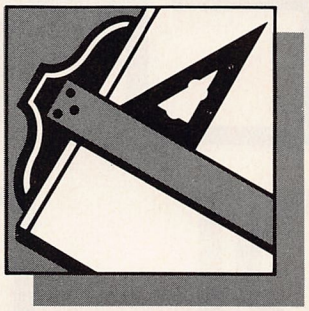
Keep in mind that many of these jobs did not even exist a decade ago and that new jobs are cropping up every day. Creative job seekers can design their own jobs by merging specific skills with company needs.



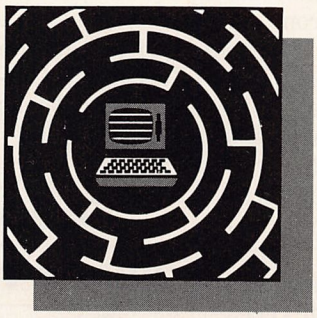
Computer Operations: *Data-entry clerks* are responsible for entering information into a computer's memory. They may work with mainframes, minicomputers, or microcomputers. Traditionally, large computers have been fed data that has been punched onto cards by *keypunch operators*. *Key-to-disk* or *key-to-tape operators* enter information directly onto magnetic media using computer terminals. Information may also be entered into some machines by *optical-character-recognition (OCR) clerks* who feed documents to the machine for scanning. These positions require typing abilities and pay up to $12,000.

Computer operators, also known as *console operators*, direct and monitor the actual operation of the computer. They decide what type of equipment is needed to run a certain job, follow instructions left by programmers, make sure all the necessary supplies are on hand, and handle maintenance that doesn't require a service technician. *Peripheral equipment operators* perform the same duties with peripheral computer equipment such as printers and disk drives. These positions usually require training provided by the hiring company or vocational/technical schools. Salaries range from $13,500 to $16,000.

According to the U.S. Department of Labor, the number of positions available for computer operators should increase by 100 percent during this decade. This enormous rise is tied to the expected increase in the number of computer systems in both large and small businesses.



Design and Engineering: *Computer engineers* and *designers* are involved in the research and development of computer systems. *Electronics engineers* may work on redesigning old equipment or developing new products to keep up with changing technology. *Mechanical engineers* design the machinery needed to produce new systems. *Computer technicians* assist designers and engineers in carrying out the actual process of creating a new machine by testing, inspecting, and sometimes designing some of the smaller components of a new machine. There are many different kinds of technicians and engineers involved in computer manufacture, with duties ranging from circuit testing to chip design. Most engineers have college and graduate degrees in engineering, and technicians generally have training from vocational/technical schools, although some companies may train their own technicians. Again, salaries depend largely on the employer. Engineers may make up to $50,000, while technicians average about $20,000. The job outlook for these careers is good. In fact, computer engineers may be in short supply by the end of the decade.



Facilities Management and Administration: *EDP (electronic data processing) managers* usually run entire data-processing departments, handling operations, personnel, and purchasing. *Database managers* handle large libraries of computerized information and interact with other department managers concerning information needs. *Project managers* oversee specific computer-based projects. *Data communications specialists* develop computer networks to handle the flow of information within a company or to and from facilities that may be geographically separate. All of these positions require previous experience in programming or systems analysis, and some require management experience. Salaries vary widely; those in staff management positions may earn from $35,000 to $60,000, and database managers generally earn about $34,000. Salaries will depend on the type and size of both the computer installation and the department or company.

The outlook for those interested in these positions is good. The number of managerial and administrative jobs will continue to grow based on the increased use of computers in business and industry.

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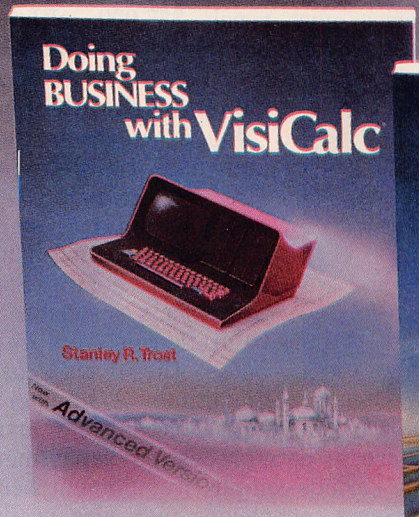

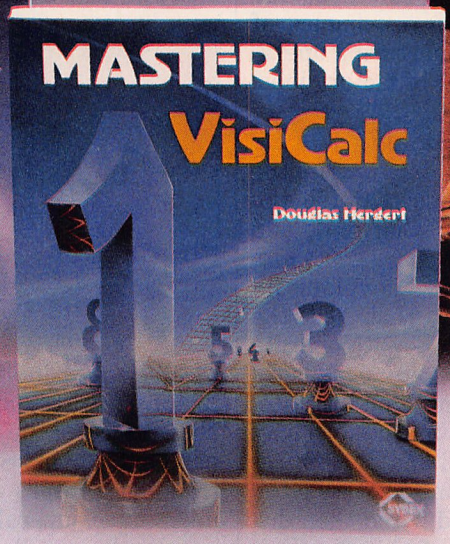

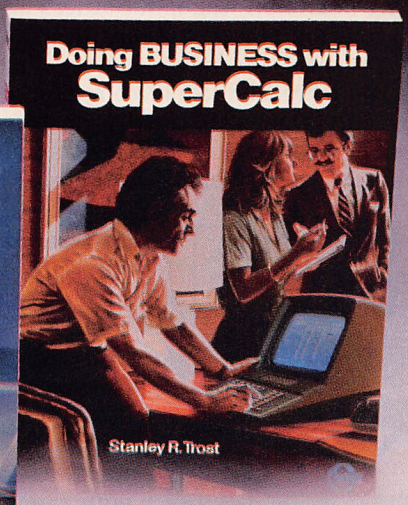

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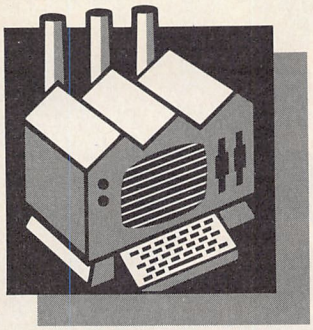

Manufacturing:

Assemblers actually put together the components of a computer. *Machinists* control the machinery used to produce specific components, and *inspectors* run tests to make sure each part is operating correctly. Other jobs in computer manufacturing involve shipping and handling, quality control, and other roles common to all manufacturing. Training for assembly work is usually provided by the manufacturer, but machinists and inspectors tend to have vocational/technical school training. Salaries vary depending on the hiring company—some jobs may pay minimum wage, but others are controlled by unions and the pay scale tends to be higher.

The prospect for many factory jobs is mediocre. While the increased use of computers should provide jobs through the end of the decade, the growing use of robots and the transfer of some manufacturing operations overseas may reduce the number of factory jobs.

Programming:

Programmers write the instructions that tell the computer what to do and how to do it. *Systems programmers* develop instructions that tell the computer how to operate itself and its peripheral equipment. For instance, systems instructions may explain to the computer how to add 2 and 2. *Applications programmers* write instructions that tell the computer what task to do—add 2 and 2 and then display the answer, for example. Salaries for applications programmers may be as high as $28,000, while systems programmers earn up to $34,000.

To date, programmers have had widely varied backgrounds—some have formal training, while others originally picked up programming as a hobby. Because employers are becoming more selective, most experts advise formal training in four-year degree programs with some specialization in a particular field of programming. Clearly, most employers searching for a business-applications programmer would favor those applicants who have solid training in business administration. All told, the U.S. Department of Labor anticipates that there will be 500,000 programming jobs available by 1990.

Systems analysts look at needs or problems within a company and design or modify data-processing systems to meet those needs. Much of the current work in this field involves designing computer operations to take over manual methods. A systems analyst will study a firm's current methods, the data that must be fed through the computer system, the information demands of the industry, the personnel needs of the system, and the overall cost of the design. Analysts may also be responsible for coordinating the training needed to put the system into operation and for instructing programmers on developing the software needed to run the entire computer system.

Many systems analysts start out as programmers, and nearly all have college or postgraduate degrees in computer science or mathematics. A large number of analysts have additional training in insurance, banking, or other fields related to particular applications. The Bureau of Labor Statistics predicts that this field will grow by 120 percent, with some 400,000 analysts employed by 1990. While the majority of these positions will be with companies, many systems analysts will offer their services on a consulting or freelance basis. Top salaries now reach $37,000, although analysts who work as consultants may earn more.

Computer Maintenance:

Field engineers, also known as *computer service technicians*, install new computer systems, do routine maintenance, and make repairs. Some technicians specialize in identifying problems before they cause costly downtime. A number of technicians handle equipment of a specific manufacturer; others are in data-processing departments and service all the various computer equipment a company may own. Some technicians may also provide training to users of the equipment. Most field engineers have several years of training in electrical engineering from colleges or vocational/technical schools, and their salaries range up to $25,000 a year. As with computer operators, the Department of Labor predicts a huge increase in this field—the number of positions should grow by 150 percent before 1990.

Support Personnel:

Technical writers produce the manuals, users guides, and other documentation to help those working with computers run and/or fix the machinery they're using. *Technical drafters* create engineering drawings or graphics for documentation. Both positions require some training: employers tend to look for documentation specialists with com-

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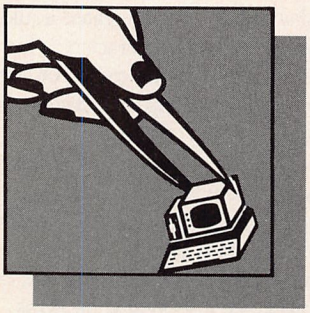
puter expertise and writing skills. Drafters must have vocational or technical school training. Technical writers may earn up to $28,000, with entry-level positions starting at $20,000. Drafters' earnings vary—most begin at $15,000.

Other support personnel include *librarians* who organize various types of computer output (tapes, cards, or disks), *word processors* who combine traditional secretarial skills with word-processing experience, and *data-control clerks* who handle mistakes or corrections in processed information. The future for these jobs remains promising as long as the use of computers increases at all levels of business.

Computer Sales and Marketing:

Positions for sales representatives in the computer industry are varied. They may work for large or small equipment manufacturers, retail stores, or service firms. Salaries for sales personnel fluctuate widely, often being based on commissions. Some employers demand a college education, but others depend on sales abilities. Most require some familiarity with computers, although employers tend to provide training for their own specific machinery or services.

Marketing technical support representatives provide technical support for marketing computer goods. They may offer training and technical presentations to users or potential buyers, sometimes providing systems analysis support as well. These positions require technical training in either a four-year computer-science program or an intensive course in technical school. Salaries range from $23,000 to $33,000, and demand is expected to remain high as products become more varied and competition more intense.



Microcomputers

While most of the resources and statistics available on computer-related jobs focus on data processing and technical positions that involve the use of mainframe or minicomputers, there's also a plethora of jobs in the youthful microcomputer field. The catch is that in this fledgling industry you often have to create these positions yourself.

The most accessible jobs in microcomputing are with hardware and software manufacturers. "We need people in software, software, software," says Cheryl Erickson of Apple Computer Inc. Specialized skills are at a premium. "We have job openings in graphics programming, for instance, but most of our applicants can offer graphics experience only on large systems, not microcomputers," she adds.

Beyond working directly for manufacturers, however, you'll find ample opportunity to carve your own niche in this burgeoning field. Some software manufacturers, for instance, not only hire staff programmers but also buy software programs from freelance writers and market them as their own.

Other microcomputer experts find freelance consulting a profitable endeavor. Major opportunities will soon exist with Fortune 500 companies because the small machines are proliferating in these firms. According to Bob Kvaal of Connexions, a Massachusetts personnel agency, "The standard data-processing people have very little competence when it comes to supporting the executives using microcomputers." The wise job seeker would follow a hardware sales representative six months later to offer his or her services to the company that has found to its chagrin that it has problems and no one to deal with them. Selling yourself as freelance consultant might be a little tricky, says Kvaal, but "when an executive purchases a computer and then can't get his annual budget out of his Visicalc model, he needs help."

While some microcomputer job seekers might want to stay independent and hire themselves out by the hour, most companies have plenty of room for internal consultants on staff, says Kvaal. "A lot of small companies have grown dependent on microcomputers and need someone to run everything," he adds.

Other opportunities in the microcomputer arena include retail sales, peripheral sales and operations, and the networking industry.

Other Careers

This has been just a sampling of the many occupations available in the computer field. Other opportunities include computer security specialists, EDP auditors, training specialists, recruitment counselors, computer consultants, college and vocational school professors, chip-design chemists, and many more.

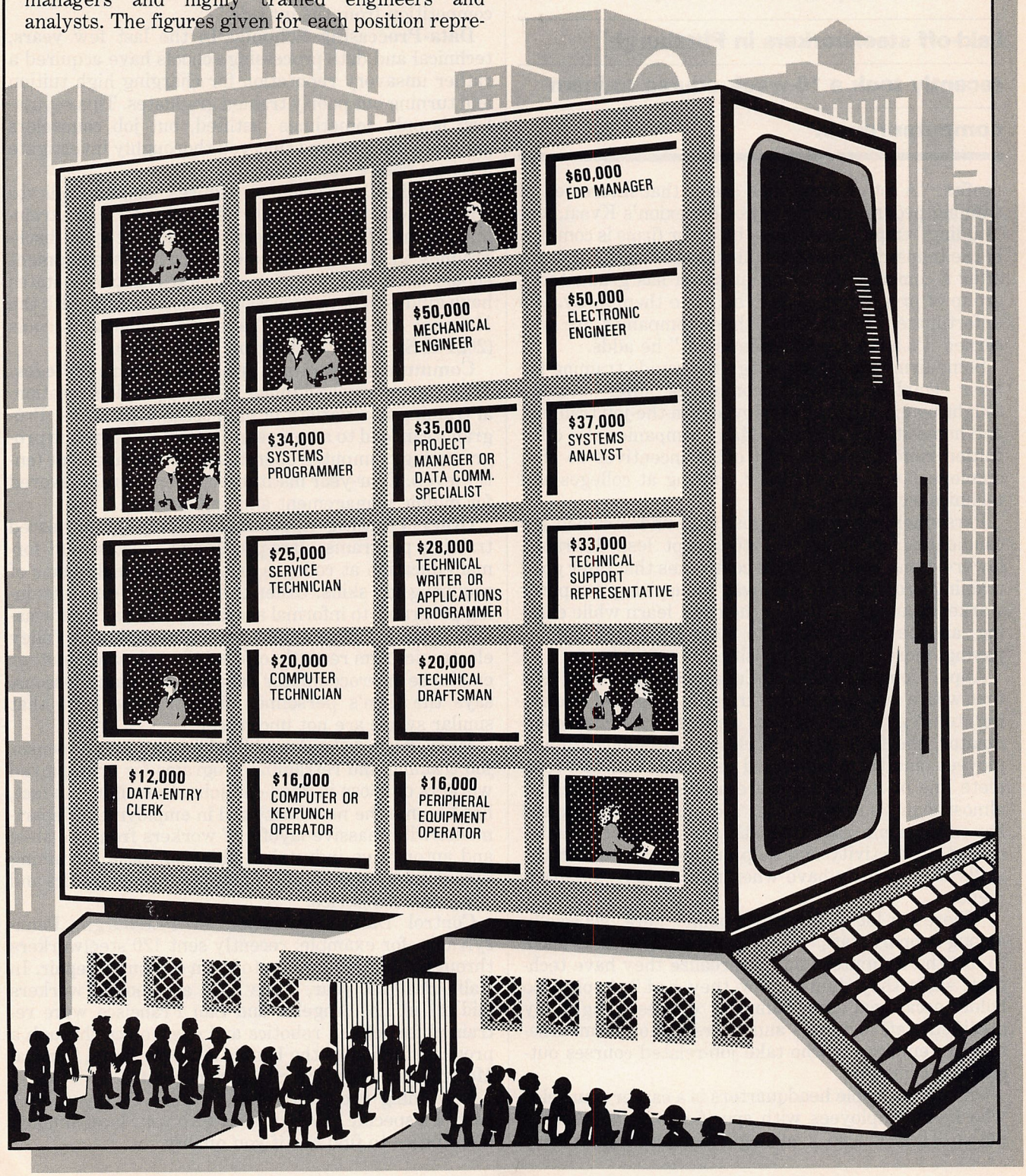
While most of the positions we've looked at involve working for a company, there are hundreds of opportunities in computing for the independent person who wants to start his or her own business. Many of the positions in the listings above can be handled on a freelance basis for small firms unable to employ their own in-house specialists. Other opportunities abound for people who want to own computer stores, write their own software and market it, market other people's software, or work as computer consultants.

Training and Education

The training and education you need to break into the computer field depend on the type of work you're after. Engineering and managerial positions require

Computer Careers from Bottom to Top

As this chart shows, job descriptions in computing range from data-entry clerks and computer operators all the way up to data processing managers and highly trained engineers and analysts. The figures given for each position represent average maximum salaries. Actual compensation figures will vary among different companies and different parts of the country.



advanced degrees, but computer operators and data-entry clerks are often fully trained by the employer.

Company training: Most firms would prefer their employees to come fully equipped with all the skills needed to perform their duties the first day on the job. Internal training programs cost money and can drain profits. "A lot of companies aren't that interested in training programmers," says Connexion's Kvaal, and "raiding" employees trained by other firms is common in the industry. "Raiders will wait two or three years after a company's training program has graduated a group of programmers and then lure them away. It's unfortunate, but as far as these companies are concerned it's a matter of self-interest," he adds.

Laid-off steelworkers in Pittsburgh recently took a 10-week course to learn computer repair.

Some firms are large enough to provide training for their employees—these companies offer courses taught by experienced employees, on-the-job training, and home-study programs. Many companies also offer tuition reimbursement and other incentives so that employees will further their training at colleges and technical schools.

Personnel managers suggest that undertrained job candidates would do well to accept less desirable, lower-paying positions with companies that offer good training programs. In this way an aspiring computer worker would get a foot in the door, learn while earning, and be in a position to move up to the higher-paying, more specialized position in a few years.

Apple Computer Inc. of Cupertino, California, is a firm with a model employee-training program. According to Peggy Redpath, a company training coordinator, the firm sponsors classes to familiarize employees (and their interested relatives) with the complete line of Apple hardware and software. Because almost every employee uses a computer at work and has one at home, says Redpath, the training classes increase productivity and help employees transfer the skills they already have when moving across departments.

"There's a lot of upward mobility here, especially among support staff," says Redpath. "They may learn to use the computer and then realize they have technical skills they didn't know they had." Apple also holds occasional programming classes taught by qualified staff members and offers tuition reimbursement to employees who take job-related courses outside the company.

On staff at Apple headquarters is a career counselor who helps employees with specific goals and career paths. There's also a management and supervisory training program called Apple University. "It makes sense for us to train our employees," Redpath continues. "Not only will they speak more intelligently about our products, but it helps us utilize our talent. Because computers are such a new field, the people who are learning about them now won't have a lot of competition from the outside."

Data-Processing Schools: In the last few years, technical and data-processing schools have acquired a rather unsavory reputation for charging high tuition and turning out poorly trained graduates. This reputation is only sometimes justified, but job counselors generally recommend that you thoroughly investigate a school before you enroll.

The school's placement figures should indicate whether local industries are depending on it as a training ground. The instructors should have good backgrounds in their fields, and the school's equipment should be in use at major corporations. Some states have guides to data-processing schools; check with the National Association of Trade and Technical Schools (2021 K St. NW, Washington, DC, 20006).

Community, Junior, and Four-Year Colleges: Most community and junior colleges provide vocational training in a variety of high-technology fields. Programs can lead to a two-year associate's degree in programming, computer operations, or management (entry level). Four-year institutions offer degrees favored for middle management and engineering.

Other Training Approaches: Company-sponsored training programs, data-processing schools, and formal education at colleges are all traditional means of acquiring job skills. Other tactics range from retraining programs to informal sharing of skills and information on the job. One employee at a large Silicon Valley electronics firm recently offered to trade with another employee microcomputer tutoring for piano lessons, says the firm's personnel director, who adds that similar swaps are not uncommon.

Many state, federal, and local governments sponsor job training and retraining programs for unemployed workers or those in dead-end jobs. Retraining, in fact, has become the new buzzword in employment departments with massive layoffs of workers from the steel and automotive industries. Many of these retraining programs are specifically geared to the electronics and computer industries.

Control Data Corporation in Pittsburgh, Pennsylvania, for example, recently sent 120 steelworkers through a 10-week course to learn computer repair. In California last year, some 8400 automobile workers laid off in Los Angeles and San Francisco were retrained for jobs in robotics and electronics through a program funded by the United Auto Workers, General Motors, and state and city governments.

Retraining programs often require that you be a part of a specific group. Check with your local employment office to find out if you qualify.

Other special groups that can provide computer skills are supported by private funds or a mixture of government and private monies and are geared to different kinds of people. The Bay Path Senior Citizens Services Inc. of Massachusetts, for example, trains senior citizens for full- or part-time data-processing work. ACS America, a software firm, sponsors a similar program for seniors in Bradenton, Florida. A group of blind programmers is being trained with braille terminals and voice synthesizers in a six-month course in Little Rock, Arkansas, under the guidance of the Arkansas Enterprise for the Blind.

At Disabled Programmers Inc. (DPI) in Campbell, California, handicapped and disabled workers are learning to program and getting unique work experience in the bargain. Candidates for the program, says DPI's Kathie Klayman, spend three months learning general skills and another three months working on special projects contracted by outside companies. Often, trainees are offered full-time work before they even get to their second three months, and the additional time is spent on the specific equipment used by the hiring companies. The work experience DPI trainees receive enables them to compete in the overcrowded entry-level job market, says Klayman, who adds that the customized courses also let the programmers be productive their first days on the job with DPI clients such as Levi-Strauss and Lockheed Missile and Space Company.

In Transition

What if you're looking for a career change and are attracted to the computing and electronics field, but you're not quite sure what's in it for you? Evergreen Valley College in San Jose, California, has designed a course called "A Transition to Electronics" to answer that very question.

Originally offered three years ago to serve the needs of displaced homemakers, the course now draws people employed in dying industries and those searching for a job change as well, says Sharon Ewert, a peer counselor for the program. The 10-week course covers basic electronics and computers and offers a sampling of the kinds of careers available in the industry. Students take field trips to Silicon Valley companies to "see the environment and talk to employees about the pros and cons of their work," says Ewert.

While the course is not intended to do more than familiarize students with the field and lead them into other training," says instructor Andrew McFarlan, some students have gleaned enough from the class to get entry-level jobs in the industry.

Other students, says Ewert, aren't considering job changes as much as trying to find out how to stay current with the changing technologies that may affect the jobs they now have. "People who merge technical skills with other talents are ensuring that their jobs won't become obsolete," she adds.

The Entry-Level Problem

The computer industry may be a job seeker's mecca, but it's not without its problems. One of the biggest is the glut of entry-level personnel, offset by a shortage of more skilled workers.

In 1982, for example, a National Science Foundation (NSF) report claimed that some 50,000 job openings were available for computer-science graduates. The report added that only 13,000 graduates would be available to fill those positions. A career in computing seemed to be the way to go, especially as the College Placement Council reported that 1981 computer-science graduates were averaging $20,000 in their first year of work, compared to the $13,000 average of liberal-arts graduates.

But last year, *Business Week*, in direct contradiction to the NFS report, revealed that there was a glut of programmers in the job market. Personnel agencies agreed that they had few listings for beginning programmers. *Business Week* accounted for the glut by noting that over 50,000 would-be programmers had completed their training and were looking for entry-level jobs.

Yet at the same time, said *Business Week*, experienced programmers were in short supply. The real message in 1982 was that those applicants who found entry-level positions were the ones who had found full- or part-time jobs during their training.

"There's still a real imbalance in the market," says personnel expert Bob Kvaal. He counsels first-time job hunters to find a way to draw on other experience. "For example, a job candidate might have previous publishing or marketing experience and be able to put it together with computers. Some firms are willing to compromise on technical talents if the candidate has other skills they need," he adds.

Karen Rubin, editor and publisher of *Making It*, a national career magazine, agrees with Kvaal. "I advise people to merge computing with things like commodities trading or the travel industry. Every industry has a place for computers, and the strict computer and data-processing industries alone can't handle all the hopefuls. Computers will filter through music, law, and the arts."

Kathie Klayman of California's Disabled Programmers Inc. advises all job candidates to specialize in a particular language or kind of machinery: "It's almost a requirement for placing any entry-level person."

Where the Jobs Are

Most computing jobs are located where the computers are—in large metropolitan areas. Some of the largest cities employing computer personnel are San Francisco and its suburbs (including the famed Silicon Valley), Los Angeles, Dallas/Fort Worth, and New York City. Massachusetts, Northern California, and the sunbelt states are the historic breeding grounds of computer manufacturers.

Microcomputer personnel are starting to see shifts in these regional trends, however, because of the flexible nature of the machines themselves and the modems and telephone lines that have made physical location less important. According to Davis Foulger, a consultant with a Connecticut market-research firm

People who merge technical skills with other talents are ensuring that their jobs won't become obsolete.

called International Resource Development, the traditional office will suffer a serious decline within a few years because fiber optics and telecommunications will allow people to work from wherever they are. Several large employers are now experimenting with programs that encourage employees to do word processing and other computer-based work at home.

It's also important to remember that careers in computing are not limited to the computing industry itself. Computer applications cross almost all industry lines, from housing and education to insurance and banking. Few companies will fail to computerize some aspect of their operations within the next decade.

To find the companies that do the most hiring of workers with computing skills, check your local library for resources. Standard and Poor's as well as other industry directories are excellent guides to employment possibilities.

How to Find Your Job

Finding your job among all those want ads in the newspaper can be a tedious task, but newspaper advertisements in heavily computerized regions are still a realistic way of finding the position you've been looking for. Going beyond the classifieds may make your search more fruitful, though.

A recent Harvard University study showed that 75 percent of all computing job placements were made through informal means—personal contacts, relatives, and professional groups. Special-interest groups are particularly numerous in computing, and users' clubs, computing groups, and professional organizations all serve to pass along the word about openings as they become available.

One such group specifically for women in professional data-processing positions is the National Association for Women in Computing (Suite 44, 55 Sutter St., San Francisco, CA 94104). According to Lee Spodick, spokesperson for the San Francisco Bay Area Chapter, the group often sponsors speakers and seminars on careers in the industry. It also promotes a network of contacts for people looking to enter or move up in the field. Membership is not limited to women, but all members are involved in programming, analysis, or management, says Spodick.

Personnel agencies that specialize in computer-related jobs are often excellent sources of jobs. Most of these agencies advertise in trade journals and local newspapers, and they usually offer help with job-hunting techniques, resumes, and understanding the local industry. Source EDP, a national recruiting firm with offices across the country, offers a series of brochures and pamphlets on career planning, industry trends, salaries, and so forth.

The newest way to look for a job is with a personal computer and a modem. Companies like Mitre Corporation of Massachusetts put job openings on their own computers and run newspaper ads inviting candidates to access the listings electronically.

Other services list resumes electronically for employers to scan. Job/Net Inc. in Massachusetts lists job openings as well as resumes. Recruiting Consortium, also in Massachusetts, holds lists of technical candidates interested primarily in small company start-ups. Florida's Career Systems Inc. and Virginia's Plenum Publishing Corporation Career Placement Registry also offer electronic listings of resumes.

One of the newest of these electronic personnel agencies is Professional Data Corporation's Connexions (55 Wheeler St., Cambridge, MA 02138). As with other services, employer listings can be accessed by microcomputer for about $15 an hour, but candidates can also interact with the firm's computers to create resumes and cover letters. Both job candidates and employers can assess one another's requirements in terms of salary, location, and other specific interests. Connexions lists large clients such as GTE, Raytheon, and Software International as well as a number of smaller firms.

Jobs for the Future

Because the computer industry is growing rapidly, the trends we've outlined here may change in the future. How can you be sure that the career you're involved in or the job you're after will remain relevant as the technology develops and changes?

The most important advice that career counselors are giving their clients is that they should remain aware of their situations. Don't assume that just because there are many job openings for a particular kind of work at the moment that it's not a dead end. Keypunch operators, for instance, are needed in most metropolitan area and jobs are fairly easy to come by. But keypunching will soon be a lost art, say industry pundits, because most keypunch operations are being shifted over to magnetic media.

Fewer data-entry clerks will be needed in the future. Optical character recognition and remote terminals for data entry are improving and may soon obviate many clerical data-entry jobs.

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though. According to Source EDP's 1983 salary survey, business and commercial applications for microcomputers are booming. Distributed data processing is also on the rise, the report adds, and microcomputer programmers, information-systems designers, network designers, and field technicians to implement the new machinery will all be in demand.

Source EDP also notes that the information industry will explode in the coming decade, providing numerous opportunities in networking and home teletext services. Source EDP also predicts rapid growth in computer-aided design and computer-aided manufacturing (CAD/CAM). "Not only will CAD/CAM systems designers be in substantial demand, but the need for new automation specialists—systems sales representatives, technicians, and graphics specialists—will grow in quantum leaps," the report notes.

The 1990s and Beyond

According to Marvin Cetron and Thomas O'Toole, authors of *Encounters with the Future: A Forecast of Life in the 21st Century* (McGraw-Hill, 1982), technical workers with an eye toward staying employed in the next decade will consider working in robotics. The authors predict that by 1990 some 1.5 million jobs for robotics technicians will be available in the U.S., with a median salary of $24,000. The authors also assert that a robotics engineer will have a "first-class ticket to the 21st century." Programmers will be needed to give those robots the capabilities they need for doing all kinds of work, and the authors forecast that roughly one million such programmers will be needed by the year 2000.

In addition to the robotics programmers and technicians, say Cetron and O'Toole, holographic specialists who will be specially trained to service the optical robots of the factories of the future will also be needed. There could be as many as 200,000 positions for such specialists by 1990.

Sound a little too futuristic? Not according to Source EDP's recent survey of 60 manufacturers, which reports that while some 25,000 workers might be displaced by robots in the next 15 years, over 50,000 new jobs will be created in the field of robotics itself.

All in all, the computer industry remains one of this country's most attractive career opportunities. The U.S. Department of Labor predicts widespread growth throughout the 1990s in all computer-related occupations except keypunch operators, data-entry clerks, and assembly workers. Whether you aspire to the lofty rank of EDP director, hope to be a computer operator or programmer, or prefer to create your own career as a microcomputer consultant, the computer field is certain to remain one of the strongest and highest-paying opportunities available in our increasingly technological age. □

For More Information

The sources listed below, several of which were cited frequently in this article, can provide more detailed information on a variety of careers in the computing industry.

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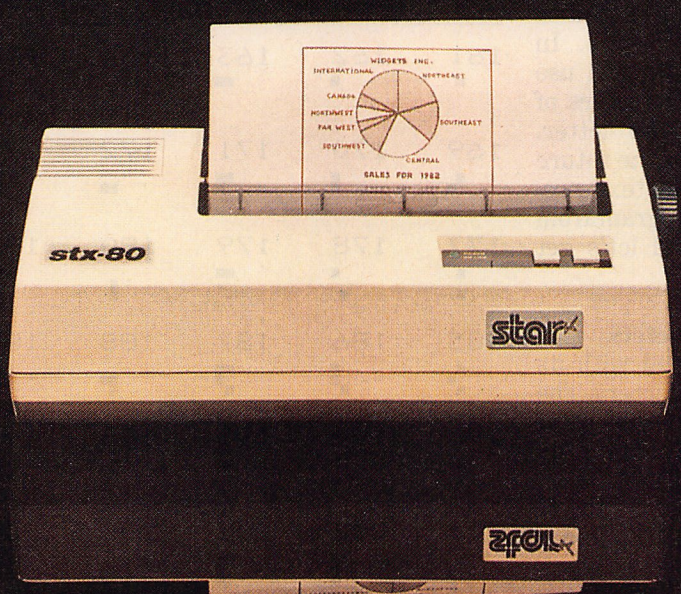


The new STX-80 printer for only $199.*

Programming Epson's MX-80 Printer: Part 3

How to use block graphics to spruce up a letter

by David Kater

This is the last in our series of three articles on the original Epson MX-80 printer (without Graftrax-80 or Graftrax Plus). In the previous articles, we used a BASIC program to explore the many features of the printer. The program prints a letter responding to customers' inquiries about products manufactured by the fictitious Starfire Operations Software. In this final installment, we will use the built-in graphics characters of the MX-80 to finish the letter. We'll also take a look at the future of printer graphics and text production. So, load the program from last month's article and let's get started.

Block Graphics Characters

The MX-80 is equipped with its own set of graphics characters. The 64 characters are composed of small rectangles in 2-column by 3-row arrangements. These characters are identical to the TRS-80 Model I and Model III block graphics (see figure 1).

If you put your MX-80 in its TRS-80 mode by changing some internal switches, the characters are printed using the same range of character codes the TRS-80 uses: 128 through 191. Unfortunately, using this switch setting severely restricts the capabilities of the MX-80, but setting switch 2-4 off will give you all the features of the printer while merely shifting the graphics character codes up by 32 to the range of 160–223. We will assume that switch 2-4 is off for the purposes of this article.

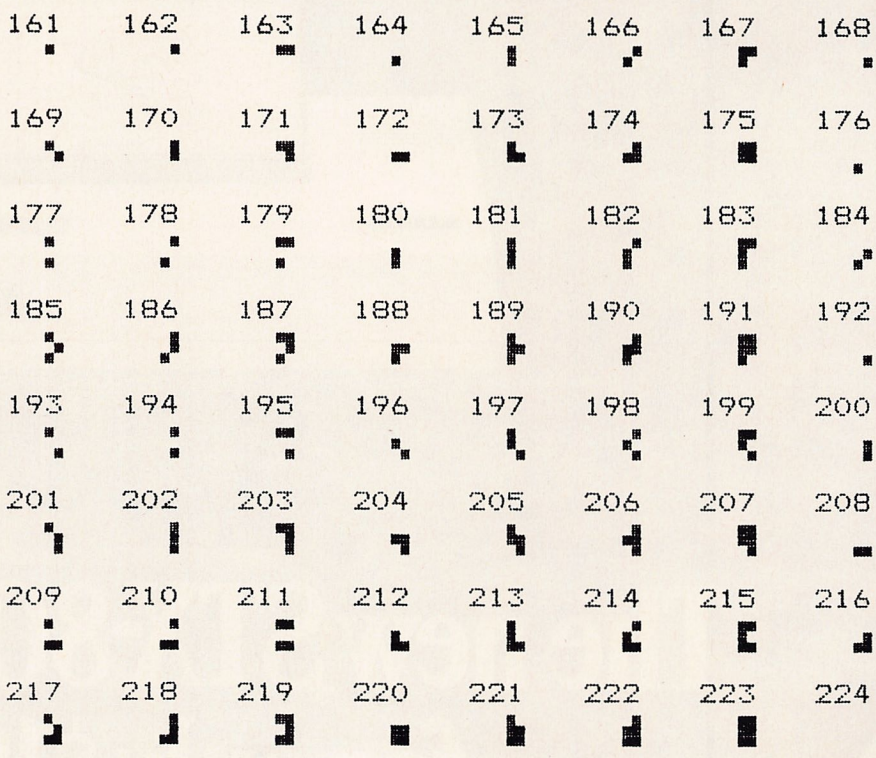
What if you don't happen to have a TRS-80? As long as your computer can send decimal numbers from 160 to 223, the printer's complete set of 64 characters is at your disposal. (Note that Apples cannot send numbers greater than 127 to the printer.)

These characters can be used to produce some interesting effects. By printing the graphics characters next to each other, we can create things like oversized letters, logos, and coupon borders. In fact, that's just what we are about to do.

Getting Down to Business

Creating graphics on the MX-80 is basically a three-step process. First you have to design the figure. You can lay it out on graph paper or use a TRS-80 Graphics Worksheet (available from Radio Shack for a nominal charge). If you use graph paper, remember that the blocks print as rectangles, not squares. Figure 2 shows the design of an oversized letter B.

Figure 1: These are the block graphics characters available on the MX-80.



David Kater, a freelance writer with an interest in printers and graphics, is author of *TRS-80 Graphics for the Model I and Model III* (Radio Shack).

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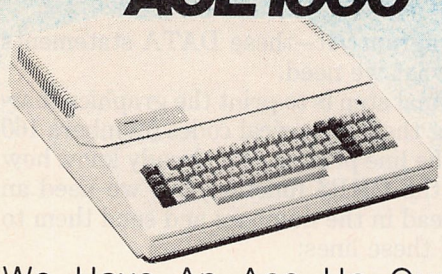

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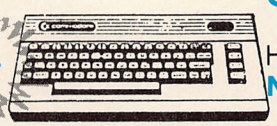

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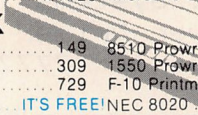

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Notice how the design is broken up into characters to determine the correct codes to send the printer. The proper codes can be found by looking up each character in figure 1. Probably the easiest way to get

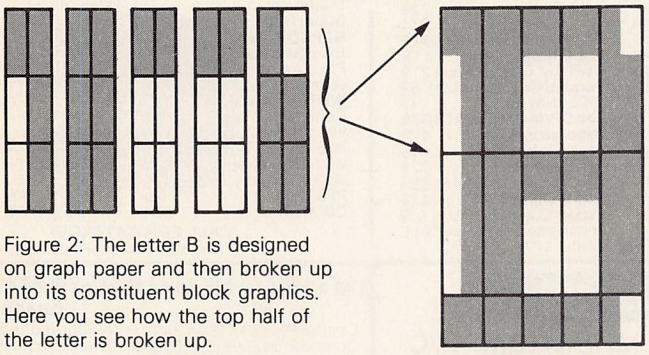


Figure 2: The letter B is designed on graph paper and then broken up into its constituent block graphics. Here you see how the top half of the letter is broken up.

the numbers into a program is to store them in DATA statements.

The DATA statements below are used to create two oversized letters, B and G. Add these lines to the program from last month's article:

```
1330 DATA 203,223,163,163,221,-12,216,191,163,163,
     173,0
1340 DATA 202,223,163,163,221,1," L O C K",-4,207,213,
     160,163,203
1350 DATA 181,1," R A P H I C S",2,0
1360 DATA 163,163,163,163,161,-13,163,163,163,163,
     151,99
```

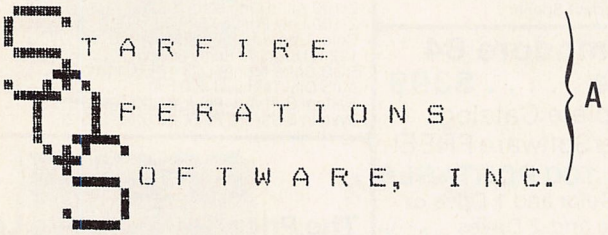
Don't run the program yet—these DATA statements are just half of what we need.

The third and final step is to print the graphics characters by sending their numerical codes (numbers 160 through 223) to the line printer. We already know how to do that with the CHR$ function, but we need an orderly way to read in the numbers and send them to the printer. Add these lines:

```
650 READ N
660 IF N>100 LPRINT CHR$(N);: GOTO 650
670 IF N=0 LPRINT: GOTO 650
680 IF N=99 THEN 730
690 IF N=1 READ A$: LPRINT A$;: GOTO 650
700 IF N=2 LPRINT N$"$30"N$"7/82";
710 FOR I=1 TO -N: LPRINT" ";: NEXT I
720 GOTO 650
730 LPRINT
```

Now run the program and compare your results to those shown in part B of figure 3.

The first number read into the variable N in line 650 is 203. Because N is greater than 100, it is sent to the printer in line 660 and control returns to line 650. This two-line loop continues until N is less than 100. When that occurs, N is tested for various values by the statements in lines 670 through 700. If N is 0, line 670 outputs a carriage return and linefeed to the printer; this starts a new line of graphics. (See lines 1330 and 1350.) The program then returns to line 650 to read the next



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Chicago, IL 77777

Dear Mr. Willson:

Thank you for your interest in our MXWRITER. Let me tell you a bit more about its great features.

LOW PRICE: You won't find another program like it in this price range.

Figure 3: The opening of the business letter in its final form. Call-out letter A designates section discussed in the text.

COLOR OPTION: Yes, we found the secret combination of software codes that unlocks the color in the MX-80. In our unique patented process, the printer breaks down the black dots into the primary colors. Unfortunately, this ad is in black and white, so you'll have to buy the **MXWRITER** in order to see the dazzling colors.

COMPATIBILITY: Thanks to our innovative programming techniques, our software runs on every computer made.

PRINT FEATURES	PRICE	AVAILABILITY DATE
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Double Width	$25	4/83
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Compressed and Double Width	NC	
Double Strike	$15	6/82
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Double Strike and Emphasized	NC	
COLOR PRINT	$50	6/82
Underlined	$12	4/83
Superscript	$15	5/82
Subscript	$23	3/82
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B BLOCK G RAPHICS	$30	7/82
SYSTEM TOTAL	$311	

C >>>>> SPECIAL OFFER <<<<<
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Figure 3 continued: More of the final letter. Call-out letters B and C designate sections discussed in the text.

number from the DATA statements.

Line 680 provides the only escape from the loop (lines 650 through 720). If N is 99, control transfers to line 730 and the program continues from there. Line 690 prints a string of characters. If N is 1, the string is read from the DATA lines into A$ and then printed, after which control returns to line 650 for more data. Notice that a 1 precedes both strings in DATA lines 1340 and 1350.

As you can see from your printout, block graphics is one of the features of the fictitious MXWRITER product. The codes needed to print block graphics were derived by breaking up customized letters designed on graph paper as shown in figure 2. Line 700 prints the price and availability of this feature. The printing in line 700 is activated by the 2 in line 1350; the negative numbers in the DATA statements are used to print blank spaces. Line 710 does the printing.

Special Offer

Let's add a few more lines to fill out the body of the letter:

```
740 LPRINT TAB(24) "SYSTEM TOTAL $311"
750 LPRINT: LPRINT TAB(8)D$">>>>> SPECIAL OFFER
    <<<<<"
760 LPRINT "For a limited time only you can get this whole
    package for"
770 LPRINT "the unbelievably low price of $200. We recommend
    that you send"
780 LPRINT "your order in now to reserve your copy of
    MXWRITER. Beat the rush."
790 FOR I=1 TO 7: LPRINT: NEXT I
```

Run these new lines and compare your results with those shown in part C of figure 3.

Lines 740–780 are fairly straightforward print lines.

CRITIC'S ACCLAIM:

I use MXWRITER for preparing all my speeches and personal correspondence. .....Martha S. Embrey, Professor.

I'm a color man. The colors you can create with MXWRITER are fantastic! .....John Koehler, Computer Graphics Specialist.

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James T. Smith, Executive Director

I've enclosed a check for the items I want.
Please rush them to the address below.

Name_____
Address_____
City_____State____Zip_____
Credit Card_____Exp Date_____
Signature_____
Orders shipped upon receipt.

} D

Figure 3 continued: The end of the business letter showing the order blank. Call-out letter D marks lines discussed in text.

Line 790 feeds the paper past the perforation to the top of the next form. A CHR$ (12) will do the same thing, but only if the top form is correctly set.

Printing a Logo

Next, we use block graphics to create a logo for the letter. Lines 1260 through 1320 are the necessary DATA statements:

```
1260 DATA 182,163,163,164,0
1270 DATA 169,172,172,176,1,"T A R F I R E"
1280 DATA 196,208,214,167,196,0
1290 DATA 160,202,160,160,202,160,1,"P E R A T I O N S"
1300 DATA 160,162,196,214,167,163,164,0
1310 DATA 160,160,160,169,172,172,176,1,"O F T W A R E
     I N C."
1320 DATA 160,160,160,196,208,208,165,0
```

A READ puts the numbers and strings into memory:

```
 50 FOR Y=1 TO 47
 60 READ N
 70 IF N=0 THEN LPRINT: GOTO 120
 80 IF N=1 THEN 110
 90 LPRINT CHR$(N);
100 GOTO 120
110 READ A$: LPRINT A$
120 NEXT Y
```


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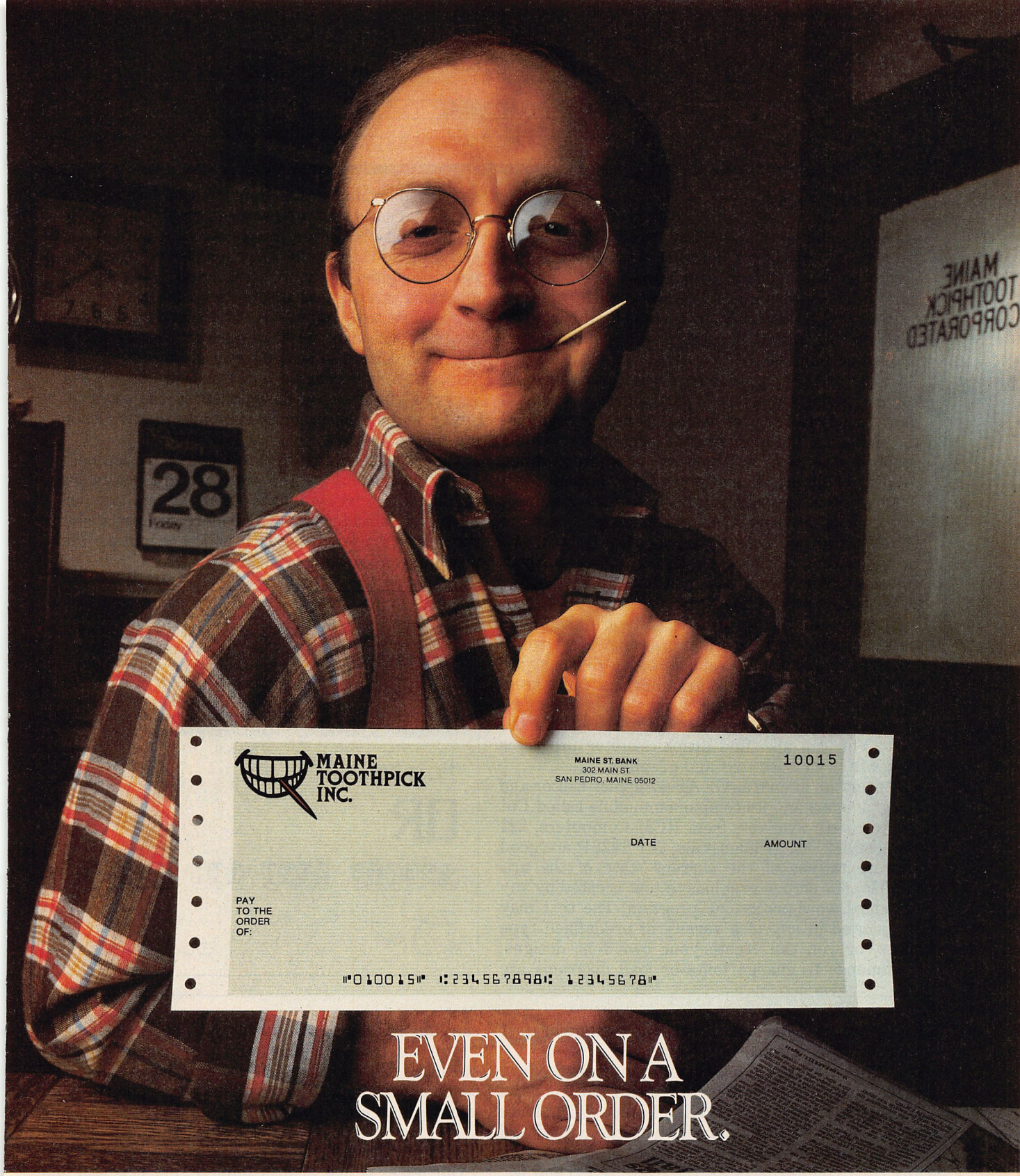

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Future Shock

As important as the original MX-80 printer has been to this fledgling industry, it really has just scratched the surface of possible printer technology. Epson has quickly followed with the Graftrax-80 and Graftrax Plus upgrades, adding high-resolution graphics capability and generally improved ease of use.

Certainly the improvements won't stop here. As competition in the printer market grows, we'll see more and more features for less money. Already we find features like color printing, super dense high-resolution graphics, built-in character fonts, greater print speed, and improved letter quality.

As printer technology advances, software must also change. Several companies have latched on to the Graftrax versions of the Epson line and now provide fine graphics support. We can also expect to see more software designed to simplify plotting in business applications.

Another promising area is software that combines graphics with word processing. Most word-processing programs available today demonstrate only a passing interest in graphics, but there are a few that make some provisions for embedding printer codes and graphics characters within the text. You can also find graphics-editor programs that will print both text and graphics.

A program known as GEAP (Graphics Editor and Programmer) and its companion module called Dot Writer (both available from RCM Computers, 221 Hirschfield Dr., Williamsville, NY 14221) are good representatives of the current state of the art. GEAP adds screen graphics to text created by any standard word-processing program. The text may be printed in any of a variety of predefined type fonts, or you can create your own font designs. Commands to change fonts or load diagrams are simply embedded in the text. Figure 4 shows the sorts of results this program can yield.

The ability to design graphics on the screen and easily blend them with text should have broad appeal. Imagine, no more cutting and pasting of diagrams and figures to get them into your text pages. Just save your works of art on disk, and the program will print them along with the text. This approach uses each type of program to its best advantage: text is created with the word-processing program, figures are designed with the graphics editor, and a print program combines the two when it's time to print.

The ultimate winner in this ongoing development is the consumer. As the software and hardware products improve, you have an easier time producing high-quality printouts. The more we learn about the printers now, the easier it will be to harness the next generation as it arrives.

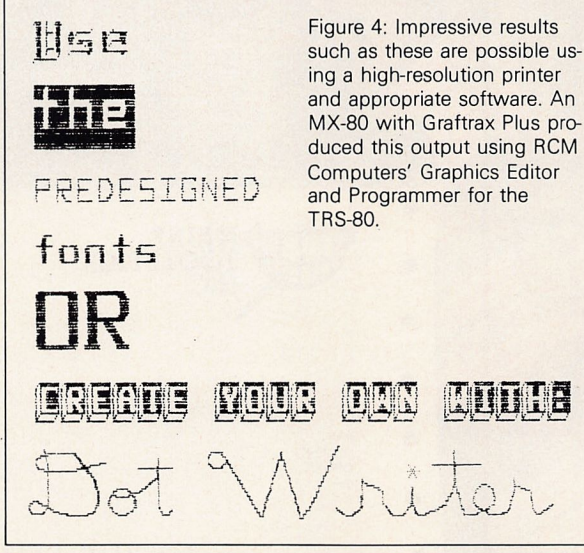

Figure 4: Impressive results such as these are possible using a high-resolution printer and appropriate software. An MX-80 with Graftrax Plus produced this output using RCM Computers' Graphics Editor and Programmer for the TRS-80.

Run the program now and check your results against the output shown in part A of figure 3.

This READ routine is a little different from the first one. To control the number of items read from the DATA lines, it uses a FOR/NEXT loop, which limits us to 47 pieces of data. Note that both the READ and DATA routines for the logo are placed in the program *before* their counterparts for the oversized B and G.

Line 60 reads in data just as line 650 does. Line 70 checks for a 0 in the DATA statements and, as before, issues a linefeed if it finds one. Line 80 checks for a 1—if N does equal 1, the program jumps to line 110 to read in the ASCII string and then print it. Line 90 is executed if a 1 isn't found. This line converts the DATA numbers into graphics characters and sends them to the printer. Line 120 jumps back to line 50 to continue reading in data until the loop is completed.

You can see how the ability to include graphics enhances the impact of the letter. The examples detailed above should give you plenty of firepower when you begin to create your own graphics.

The Order Blank

Our letter is just about complete, but it is still missing the omnipresent order blank. We'll lay the groundwork for this by creating subroutines to print strings of characters. Some computers have a STRING$ function that repeats a single character up to 255 times; without such a function you must use a simple loop instead. We've arranged the three loops below as subroutines to be used in the last part of the program. Add these lines:

YOU CAN MAKE A FORTUNE IN MICROS!

THE MICRO COMPUTER BUSINESS WILL GROW FROM $10 TO $100 BILLION IN THE NEXT EIGHT YEARS! ARE YOU READY TO CASH IN?

The **micro computer business** is predicted to grow from its present $10 billion to **$100 billion** before 1990! Imagine the possibilities this opens for you! No matter where you live, if you're starting up or presently in business, **no other industry offers you more opportunities!**

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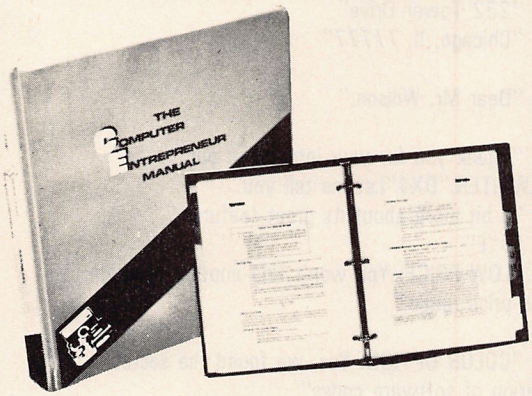
We'll show you **inside tricks,** like how to **never again pay retail** for computer products and consumer electronics, **even for one item - right now,** while you're starting your business! How to get **free merchandise** and trade show **invitations, etc. This alone** will **more than pay** for the **manual!** You'll read **actual case histories** of other computer entrepreneurs, so you can **learn** from **their mistakes,** and **profit** from their **success stories! Where** you'll be **one year** from now depends on **your actions today!** Let us **show you how** to take the **first crucial steps!**

Order now and take **advantage** of our **limited introduction special, THE COMPUTER ENTREPRENEUR MANUAL,** and a **six month subscription to THE COMPUTER ENTREPRENEUR REPORT/NEWSLETTER** (so you're **always up-to-date** with the industry), **both** for **only $29.95! You must** be **convinced** on **how easy** you can **strike it rich** in the micro computer business - or you may **return** the manual for **a full refund** within thirty days! **USE OUR TOLL FREE NUMBER TO ORDER!**



EVERYTHING YOU NEED TO KNOW TO SUCCEED IN THE COMPUTER BUSINESS IS ALL IN THIS MANUAL!

THE COMPUTER ENTREPRENEUR MANUAL has the **answers** to **all your questions** about **selecting, starting** and **succesfully running a computer business!** There has **never** been such a **comprehensive collection** of **know-how** and **information** about this business **in one place! All the facts you need** to **plan** and **acheive your goals** in **easy-to-follow, step-by-step instructions!**

These are some of the **100-plus businesses** covered in **PART ONE** of the manual, with the facts on **How to start and run, Start-up Cost (Even** how to operate **on a shoestring),** What **profits to expect, Wholesale prices, Mark-ups, Suppliers, future outlook, case histories** for **each, etc:**

Systems House, Software Author (who to sell to and who to avoid), **Service Bureau, Software Publisher** (How to find programs that sell, **Word Processing Service, Consulting** and **Consultant Broker** (use your skills or those of others, **make** $150 - $1000 **a day!),** The **incredible Games Business, Computer Store** (Franchises: Pro and Contra, or a low inventory store **in your home!), OEM, Hardware Mfg, Data base** and **Teletext Service (big prospects!), Used Computers, Repairs, Rent-A-Computer, Promote Fests** and **Trade Shows, Turnkey Systems, Bartering, Mail Order, Compile and rent mailing lists, Specialized Data Headhunting** and **Temp Help Service, Tech Writer Shop, Custom Engineering,** The **highly profitable Seminars** and **Training Business , and many more!**

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Circle 131 on inquiry card.

```
1200 FOR I=1 TO N: LPRINT CHR$(C); : NEXT I
1210 RETURN
1220 FOR I=1 TO N: LPRINT CHR$(95); : NEXT I
1230 RETURN
1240 FOR I=1 TO N: LPRINT " "; : NEXT I
1250 RETURN
```

The first subroutine, lines 1200–1210, is a general loop for printing strings of characters. It prints N repetitions of the character C. (We have to define N and C before using the routine.) The next two routines are for two particular characters that will be heavily used in the printing that follows. Line 1220 prints underlines and line 1240 prints blank spaces.

These next few lines give us a good start on our customized order blank:

```
  40 Z$=CHR$(181):B$=CHR$(202)
1040 LPRINT E$"D"CHR$(48)CHR$(0)
1050 LPRINT CHR$(188);:N=47: C=172: GOSUB 1200 :
     LPRINT CHR$(204)
1060 LPRINT Z$ " I've enclosed a check for the items I want.
     "B$
1070 LPRINT Z$ " Please rush them to the address below. "B$
```

Run the program now and you should get the top half of the order blank as shown in part D of figure 3. All we need are these last few lines to complete the order blank and the program:

```
1080 LPRINT Z$;: N=47: GOSUB 1240: LPRINT B$
1090 LPRINT Z$" Name";: N=39: GOSUB 1220: LPRINT N$B$
1100 LPRINT Z$" Address";: N=36: GOSUB 1220: LPRINT
     N$B$
1110 LPRINT Z$" City";: N=10: GOSUB 1220: LPRINT"State";:
     N=4: GOSUB 1220: LPRINT"Zip";: N=17: GOSUB
     1220: LPRINTN$B$
1120 LPRINT Z$" Credit Card";: N=15: GOSUB 1220:
     LPRINT"Exp Date";: N=9: GOSUB 1220: LPRINT N$B$
1130 LPRINT Z$" Signature";: N=34: GOSUB 1220: LPRINT
     N$B$
1140 LPRINT Z$" Orders shipped upon receipt."N$B$
1150 N=49: C=163: GOSUB 1200: LPRINT
1160 END
```

Your final letter should be divided into two pages and look like the whole of figure 3. In line 1080, we use our space routine to print spaces between borders. Lines 1090–1130 use our underline routine to print blanks between words.

Final Program Listing

Here is the complete listing of the BASIC program developed in this series of three articles. Keep in mind that it is designed for standard Microsoft BASIC. Most users will have to make some modifications to get the final result shown in figure 3.

```
  10 C$=CHR$(15):CX$=CHR$(18)
  20 D$=CHR$(14):DX$=CHR$(20)
  30 E$=CHR$(27):N$=CHR$(9)
  40 Z$=CHR$(181):B$=CHR$(202)
  50 FOR Y=1 TO 47
  60 READ N
  70 IF N=0 THEN LPRINT: GOTO 120
  80 IF N=1 THEN 110
  90 LPRINT CHR$(N);
 100 GOTO 120
 110 READ A$: LPRINT A$
 120 NEXT Y
 130 LPRINT C$
 140 LPRINT TAB(14) D$ "75 Long Street"
 150 LPRINT TAB(14) D$ "New York, New York"
 160 LPRINT CX$
 170 LPRINT "November 20, 1982"
 180 LPRINT
 190 LPRINT "Kirk T. Willson"
 200 LPRINT "General Systems INC."
 210 LPRINT "232 Tower Drive"
 220 LPRINT "Chicago, IL 77777"
 230 LPRINT
 240 LPRINT "Dear Mr. Willson:"
 250 LPRINT
 260 LPRINT "Thank you for your interest in our "
     D$"MXWRITER."DX$"Let me tell you"
 270 LPRINT "a bit more about its great features."
 280 LPRINT E$"E"
 290 LPRINT "LOW PRICE: You won't find another program like
     it in this price range."
 300 LPRINT
 310 LPRINT "COLOR OPTION: Yes, we found the secret
     combination of software codes"
 320 LPRINT "that unlocks the color in the MX-80. In our
     unique patented process,"
 330 LPRINT "the printer breaks down the black dots into the
     primary colors."
 340 LPRINT "Unfortunately, this ad is in black and white, so
     you'll have to buy"
 350 LPRINT "the ";D$;"MXWRITER";DX$" in order to see the
     dazzling colors."
 360 LPRINT
 370 LPRINT "COMPATIBILITY: Thanks to our innovative
     programming techniques, our"
 380 LPRINT "software runs on every computer made. "
 390 LPRINT
 400 LPRINT E$"D";CHR$(39);CHR$(52);CHR$(0)
 410 LPRINT E$"F";E$"G";"PRINT FEATURES";
 420 LPRINT N$"PRICE";N$"AVAILABILITY DATE"
 430 LPRINT E$"H";
 440 LPRINT E$"D" CHR$(40) CHR$(60) CHR$(0)
 450 LPRINT "MXWRITER with normal print "N$"$95"N$
     "3/82"
 460 LPRINT D$"Double Width"DX$N$"$25"N$"4/83"
 470 LPRINT C$"Compressed" E$"A"CHR$(1)E$"2"
 480 LPRINT CX$N$"$12"N$"5/82"E$"A"CHR$(11)E$"2"
 490 LPRINT C$D$"Compressed and Double Width"E$"A"
     CHR$(1)E$"2"
```

CONTINUED ON PAGE 150

If you're ready to learn intermediate BASIC programming

STEP BY STEP TWO IS READY FOR YOU!

In Each Parentheses, Choose One:

If you're one of the (happy, smart, ecstatic) thousands who learned (quickly, clearly, non-boringly) to use their APPLE computers with our beginners' BASIC tutorial, *The New Step By Step*, then we (know, believe, swear) that *Step By Step Two* is ready to (ease, breeze, squeeze) you into the (advanced, intermediate, grown-up) world of PEEK and POKE, hexidecimal numbers, concatenations, and (much, much, much) more.

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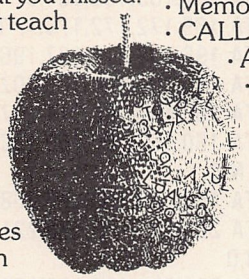
- A friendly voice that guides you to course completion



The *Step By Step Two* program works this way:

- the computer program sets up screen displays or sample programs for you.
- the cassette voice tells you what's happening.
- you (deal with, figure out, guess at) the answer.
- the computer (praises, pans) your work.
- you (peruse, plunge into, practice in) the Work Book.
- after each lesson, you're (quizzed, queried, questioned).
- you're then (prepared, practiced, primed) for the next lesson.
- the final exam reveals all (superstars, slackers).

There's lots to learn in *Step By Step Two:*

- PEEK & POKE
- Default values
- Memory map
- CALL program
- ASCII codes
- CHR$ and ASC functions
- control characters
- RAM vs ROM
- hexidecimal numbers
- machine monitor
- string logic
- string arrays
- high resolution graphics
- screen memory

But don't take our (word, words, wordiness) about how (good, great, grand) the *Step By Step* method is. Listen to our (critics, reviewers, friends):

"If you want to learn BASIC or would like a little guidance and encouragement added to what you already know, then the way to go is *Step By Step.*" —Softalk

"The *Step By Step* approach is the next best thing to having an experienced programmer by your side... *Step By Step* is a superb example of a successful blend of various media. The teaching principles are sound, the execution is virtually flawless, and the whole thing works." —Popular Computing.

If you want to move ahead in BASIC programming, the next (simple, logical, shrewd) step is *Step By Step Two.*

Step By Step Two is available at fine retail stores or direct from PDI for $89.95 plus $3.00 shipping and handling. (The package includes back-up discs.)

P.S. If you've yet to take your first step into BASIC, it's time to get *The New Step By Step!* Same great tutorial techniques, for $79.95 plus $3.00 shipping and handling.

PDI

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```
500 LPRINT CX$DX$N$" NC"E$"A"CHR$(140)E$"2"
510 LPRINT CX$E$"G" "Double Strike" N$"$15"N$"6/82"
520 LPRINT E$"H" E$"E" "Emphasized"N$"$16"N$"2/83"
530 LPRINT E$"G" "Double Strike and Emphasized"N$" NC"
540 LPRINT E$"H"E$"F" "COLOR PRINT"N$"$50"N$"6/82"
550 LPRINT "Underlined"N$"$12"N$"4/83"E$"A"
    CHR$(5)E$"2"
560 LPRINT E$"1" "----------"
570 LPRINT C$"Super"E$"A"CHR$(3)E$"2"
580 LPRINT TAB(3) CX$" script"N$"$15"N$"5/82" E$"A"
    CHR$(140)E$"2"
590 LPRINT TAB(3) " script"N$"$23"N$"3/82";E$"A"
    CHR$(3)E$"2"
600 LPRINT C$TAB(3)"Sub"E$"A"CHR$(140)E$"2":LPRINT
    CX$;
610 LPRINT TAB(4) "ia"E$"A" CHR$(3)E$"2"
620 LPRINT TAB(3) "r"TAB(6)"b" " line spacing"N$"$18"
    N$"9/82"
630 LPRINT TAB(2)"a"TAB(7) "l"
640 LPRINT "v"TAB(8)"e"E$"A"CHR$(140)E$"2"
650 READ N
660 IF N>100 THEN LPRINT CHR$(N);: GOTO 650
670 IF N=0 THEN LPRINT: GOTO 650
680 IF N=99 THEN 730
690 IF N=1 THEN READ A$: LPRINT A$;: GOTO 650
700 IF N=2 THEN LPRINT N$"$30"N$"7/82";
710 FOR I=1 TO -N: LPRINT" ";: NEXT I
720 GOTO 650
730 LPRINT
740 LPRINT TAB(24)"SYSTEM TOTAL $311"
750 LPRINT: LPRINT TAB(8)D$">>>>> SPECIAL OFFER
    <<<<<"
760 LPRINT "For a limited time only you can get this whole
    package for"
770 LPRINT "the unbelievably low price of $200. We
    recommend that you send"
780 LPRINT "your order in now to reserve your copy of
    MXWRITER. Beat the rush."
790 FOR I=1 TO 7: LPRINT: NEXT I
800 A$="CRITIC'S ACCLAIM:": GOSUB 1170
810 LPRINT "I use MXWRITER for preparing all my speeches
    and personal"
820 LPRINT "correspondence. ...Martha S. Embrey, Professor."
830 LPRINT
840 LPRINT "I'm a color man. The colors you can create with
    MXWRITER are"
850 LPRINT "fantastic! ...John Koehler, Computer Graphics
    Specialist."
860 LPRINT
870 A$="SUPPORT:": GOSUB 1170
880 LPRINT "We have the top technical people in the business.
    Ask for Fred"
890 LPRINT E$"A" CHR$(5) E$"2";
900 LPRINT "Winsor. He is always available to help with any
    software problems."
910 LPRINT TAB(15) E$"1" "------"
920 LPRINT E$"A"CHR$(140)E$"2"
930 A$="DISCLAIMER:": GOSUB 1170
940 LPRINT C$"Starfire offers this program AS IS and assumes
    no liability in the ";
950 LPRINT "event of damages as a result of the use of this
    program."
960 LPRINT
970 A$="GUARANTEE:": GOSUB 1170
980 LPRINT "MXWRITER has a 3 year warranty, during which
    we will replace"
990 LPRINT "damaged diskettes free of charge."
1000 LPRINT
1010 A$="FUTURE ATTRACTIONS:": GOSUB 1170
1020 LPRINT "Look for our upcoming software—graphics
     programs for your EPSON."
1030 LPRINT: LPRINT N$;"James T. Smith, Executive Director":
     LPRINT
1040 LPRINT E$"D"CHR$(48)CHR$(0)
1050 LPRINT CHR$(188);: N=47: C=172: GOSUB 1200:
     LPRINT CHR$(204)
1060 LPRINT Z$ "I've enclosed a check for the items I want. "B$
1070 LPRINT Z$ " Please rush them to the address below. "B$
1080 LPRINT Z$;: N=47: GOSUB 1240: LPRINT B$
1090 LPRINT Z$" Name";: N=39: GOSUB 1220: LPRINT N$B$
1100 LPRINT Z$" Address";: N=36: GOSUB 1220: LPRINT
     N$B$
1110 LPRINT Z$" City";: N=10: GOSUB 1220 :LPRINT"State";:
     N=4 GOSUB 1220: LPRINT"Zip";: N=17: GOSUB
     1220:LPRINT N$B$
1120 LPRINT Z$" Credit Card";: N=15: GOSUB 1220: LPRINT
     "Exp Date";: N=9: GOSUB 1220: LPRINT N$B$
1130 LPRINT Z$" Signature";: N=34: GOSUB 1220: LPRINT
     N$B$
1140 LPRINT Z$" Orders shipped upon receipt."N$B$
1150 N=49: C=163: GOSUB 1200: LPRINT
1160 END
1170 LPRINT C$D$;A$
1180 LPRINT CX$
1190 RETURN
1200 FOR I=1 TO N: LPRINT CHR$(C);: NEXT I
1210 RETURN
1220 FOR I=1 TO N: LPRINT CHR$(95);: NEXT I
1230 RETURN
1240 FOR I=1 TO N: LPRINT " ";: NEXT I
1250 RETURN
1260 DATA 182,163,163,164,0
1270 DATA 169,172,172,176,1,"T A R F I R E"
1280 DATA 196,208,214,167,196,0
1290 DATA 160,202,160,160,202,160,1,"P E R A T I O N S"
1300 DATA 160,162,196,214,167,163,164,0
1310 DATA 160,160,160,169,172,172,176,1,"O F T W A R
     E, I N C."
1320 DATA 160,160,160,196,208,208,165,0
1330 DATA 203,223,163,163,221,-12,216,191,163,163,
     173,0
1340 DATA 202,223,163,163,221,1," L O C K",-4,207,
     213,160,163,203
1350 DATA 181,1," R A P H I C S",2,0
1360 DATA 163,163,163,163,161,-13,163,163,163,163,
     161,99
```

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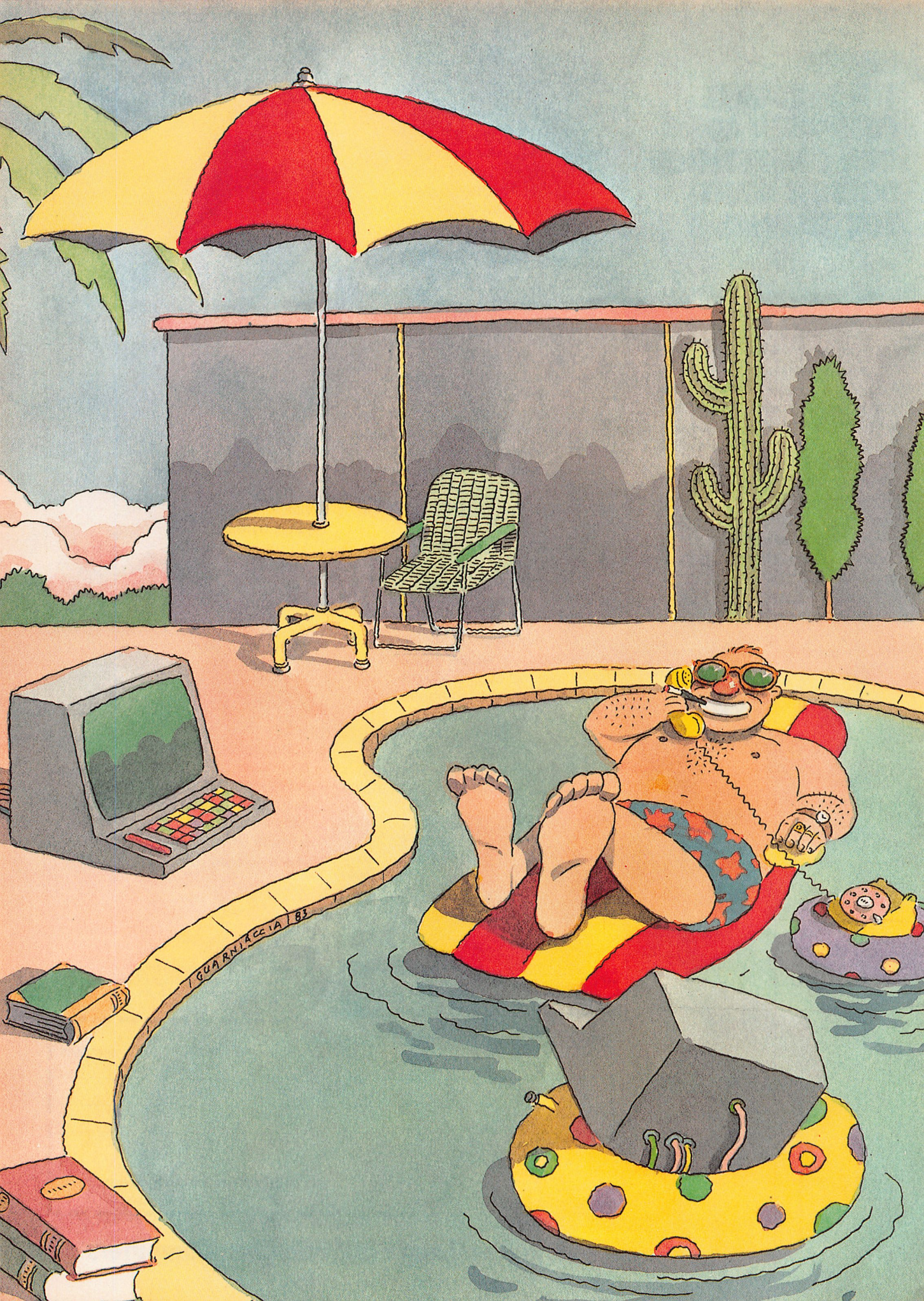
GUARNIACCIA 83

HOLLYWOOD: The New Script Calls for Computers

Writers for the silver screen are falling in love with the computer screen

by Barbara Elman

Charlie Haas, coauthor of last year's acclaimed Disney movie, *Tex*, isn't the kind of guy who likes to pour money down a rat hole. "Like most screenwriters, I'd pay dearly for any gizmo that could help me write perfectly paced screenplays that come out exactly 116 pages long," he says. "But before I buy any hardware, I've got to be convinced that the screenwriting software can accomplish things that I can't do with an electric typewriter and two tab stops."

Haas has good reasons for resisting a $5000 impulse purchase. For the past few years, screenwriters and computer salespeople have been dancing around each other like patrons of a singles bar. Retailers know that the 6200 members of the Writers Guild of America (the TV and film scenarists' union) have plenty of money to invest in computer systems. The dealers' sales spritz is both helpful and infuriating to screenwriters, who know that any system they buy is going to get a real workout: an average teleplay runs about 30 pages per half-hour episode; most movie scripts are between 115 and 130 pages long. Some scripts—especially TV sitcoms—go through seven or more drafts.

By most accounts, Hollywood's fence-sitting period is about over. A host of bellwether writers (not to mention producers and actors) have already put the dust covers on their Selectrics for good. Peter Feibleman, a screenwriter currently working with Warren Beatty and Elaine May (who collaborated on the script for the 1978 film *Heaven Can Wait*), helped beta test the Epson QX-10 microcomputer. Gene Roddenberry, writer/producer of both the "Star Trek" TV series and its motion-picture spin-offs, owns two Lexor dedicated word processors—one for his home, the other for his office at Paramount Pictures. TV writer/producer Glen Larson ("Battlestar Galactica" and "Knight Rider") uses a Xerox 860 word processor and a Dataset 2800 modem to send scripts from his home in Hawaii to his office in Los Angeles.

Computerized Screenwriting—Take One

John Riley is a former journalist (correspondent for both *Time* and *Newsweek*) who broke into TV writing last year with *For Ladies Only*, an NBC "Movie of the Week" about male strippers. "The constant retyping of that script made me think about improved technology," Riley recalls. "I rewrote—hence, retyped—some scenes 10 to 15 times. Today I own a North Star Horizon II with a Viewpoint monitor from Applied Digital Data Systems and a C. Itoh Starwriter printer. I use Magic Wand word-processing software for the basic text editing, and for formatting and printing the text I use Screenplay, a program that I'm distributing through my own company in Beverly Hills (see text box, page 157). I look forward to writing on the North

Barbara Elman edits and publishes *Word Processing News* in Hollywood.

Illustration by Steven Guarnaccia

Star every day, which was not always the case with typewriting."

Another early convert to word processing is screenwriter Mike Gray (*The China Syndrome* and the forthcoming *Wavelength*). "After four years of using a word processor, I find it impossible to function without one," he claims. "It improves the quality of my work by allowing me to refine dialogue almost effortlessly."

Some screenwriters are less starry-eyed about the wonders of word processing. Michael Crichton, the triple-threat author/screenwriter/director (*The Andromeda Strain, Coma, Congo*) who once dismissed Hollywood and his alma mater, Harvard, as being "the two most self-congratulatory places on earth," feels that word processors are useful, not awe-inspiring. "Let's not get overly dramatic about it," he cautions. "Word processing is just glorified typewriting. Of course, word processing greatly simplifies the process of rewriting, but there's a danger in that. It tempts you to fiddle around endlessly with your words because it's so much easier than working with paper."

Hollywood's opinion-molders—people like Francis Ford Coppola and Warren Beatty—have spurred the interest in word processors.

Although the Writers Guild has sponsored computer demonstrations and workshops on both coasts, Crichton jumped right into computing without any handholding whatsoever. "I had read nothing about word processors prior to my first purchase," he confesses. "Somebody told me about them, and I went out and bought one. I have three systems now—a dedicated Olivetti TES-701 word processor for the majority of my business work, an Apple II which I find too slow and clumsy for writing, and a Sony Typecorder for notes while traveling.

"My philosophy about equipment is that you can waste a lot of time in detailed evaluation of competing systems. I've watched writer friends spend weeks agonizing over different brands, finally buying one that's a few bucks cheaper or has a fancy screen. In an area as well-defined as word processing, I think you should treat competing systems like toothpaste: they're all essentially the same, and marginal differences are just that—marginal."

John Riley, on the other hand, had a more difficult time. "My friend Michael Parrish had a North Star system that he'd bought after a year's research. But I wanted to do my own legwork, so I did all the obligatory things: going to computer shows, reading magazine articles, wandering into computer stores and finding out how dumb most of the salespeople were. Finally, I bought an enhanced version of Michael's North Star system, reluctantly coming to the conclusion that he'd made the right decision."

Once Riley had the system unpacked, he discovered that "writing with the aid of a computer is about as easy to learn as, say, black-and-white photography. There are definitely new concepts to absorb, but I was able to learn them easily. Writers who have no technical self-confidence may have difficulties."

Wes Craven, who has used an Apple II to write several successful horror flicks (*Deadly Blessing, A Stranger in the House*), feels that his computer dealer let him down. "The idea of a word-processing system being something you master in a few hours is utterly laughable to me and something of a cruel joke being played by those who sell them," says Craven.

Both Crichton and Gray prefer dedicated word processors to microcomputers. Says Crichton, "You're giving up programmability with a dedicated word processor, but you're getting a machine that's easier to use, and the vendors generally give better support. In contrast, a microcomputer comes with a manual, some floppy disks, and a number to call if you get stuck. The number is always busy."

After four trouble-free years of leasing a Wang dedicated word processor, Gray decided that portability was important too, so he bought an Osborne 1 and began running Wordstar. "I find Wordstar more dangerous than the Wang," he confides. "If you hit QY, you delete everything on the line, and if you hit QYQ, the computer repeats the command over and over again and wipes out your entire document line by line before you can stop it. The Osborne is not as friendly as a dedicated word processor, which is very cautious and asks you questions before deleting anything."

Communal Computers

Wordplay is a business located in West Hollywood that fills a unique need in the greater L.A. area: writers who can't afford computer systems can go there to rent word-processing time by the hour. Co-owner Bob Dietz reports that half his customers are writers, and half of those write scripts. Episodes of "M*A*S*H" and "T.J. Hooker" have been composed on Wordplay's Atex text-editing system, which offers custom programs for TV/movie scripts.

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13 CONTINUED: 13

SANDY
(as if reading)
John Phillips. I see it

JOHN
That's who I am.

SANDY
Good to see you again, John. Leave your pictures. Maybe I can get them to Bob Merlis.

Smiling, John replaces the imaginary card in his wallet, which he puts back in his pocket.

JOHN
Thank you, Sandy. My phone number is on the resume in case he wants to call me.

Sandy receives the envelope from him, opens it, removes the resume. She locates on it the telephone number, smiles.

SANDY
Half the actors in Manhattan use that answering service.

JOHN & SANDY
(in unison, slightly off-synch)
It's ten dollars a month.

She reaches into his pocket for his imaginary Equity card.

SANDY
Well, good luck...
(reads)
John Phillips. Welcome to New York.

14 INT. BARE STAGE - DAY 14

Beneath a large sign that reads: "Open Casting Call," John joins a score of young male ACTORS sitting in folding chairs. They mutter among themselves, watched by a young GOFER, who officiously carries a clipboard. A small, rude DIRECTOR summons them one at a time with peremptory gestures. He puffs nervously at a cigarette as they audition for him with only the same single line.

(CONTINUED)

Software For Screenwriters

Page 9 of John Riley's script for the NBC movie *For Ladies Only*. Riley formatted the script with Screenplay, a software package sold by his Beverly Hills firm.

- Page number
- Scene number
- Character names are capped and centered
- Dialogue is upper- and lowercase and indented
- New scene
- Scene changes and stage directions are single-spaced and about 55 characters wide

If you're not familiar with what's known as "standard screenplay format"—the Writers Guild of America guidelines for how a teleplay or movie scenario should be typed—take a look at the page at left, excerpted from John Riley's script for an NBC "Movie of the Week" entitled *For Ladies Only*. You'll notice that the script uses different margins for actors' directions and dialogue.

Trying to create a screenplay by using only Wordstar or Perfect Writer is quite onerous because of all the margin resets. That's why screenwriters are so excited about two text-formatting programs, Screenplay and Scriptor, which automatically set the margins and make page breaks.

Writers Guild member Riley and his business associate, John Dilley, are the creators of Screenplay ($395), a program that uses embedded codes (characters that appear on the computer screen but don't get printed) to tell the printer where to break pages, reinvoke character names, place scene numbers, and more. "When you get to the bottom of a page, Screenplay will break the dialogue at a period if possible," explains Riley. "Screenplay is a CP/M-based program that runs in conjunction with any CP/M text editor you like—Magic Wand, Wordstar, whatever. You use the word-processing program to enter the text of your screenplay, then you close the file and insert the Screenplay disk before outputting. Our program makes sure that the output conforms to standard screenplay format."

Riley feels that the majority of screenwriters are still technologically backward. "Many Guild members have simply accepted the IBM Selectric as the ultimate office tool," he shrugs. Riley's firm configures Screenplay disks for Northstar and Apple CP/M and for 8-bit IBM Personal Computer processors. More information can be obtained from Automated Screenplay Systems, POB 1823, Beverly Hills, CA 90213, (213) 278-2938.

Riley has crosstown competition from Screenplay Systems, a company in Burbank, California, that sells a text formatter known as Scriptor. Co-owner Stephen Greenfield has impeccable credentials in both computing and filmmaking. While in high school, he was a programming intern at Case Western Reserve in Cleveland, Ohio. He later worked his way through the University of Southern California Film School, programming the school's DEC 10 computer from Digital Equipment Corporation.

"A word-processing program is very compartmentalized," says Greenfield. "You have a routine that creates the display window, plus commands that affect what's in the text buffers, and so on. In screenplay processing, all the parts are interrelated, and that's what makes debugging so difficult." Scriptor, written in Pascal, is a more elegant program than Screenplay. The former has a higher price tag ($495) because it's a friendlier program that doesn't require the entry of any embedded codes whatsoever. Scriptor, like Screenplay, is a text formatter used after you close the files created with a CP/M-based word-processing program. Greenfield and partner Chris Huntley recommend either Wordstar or Perfect Writer as the ideal complement for their product.

Screenplay Systems can tailor Scriptor to most CP/M-based systems. If you're using a CP/M word processor to write next year's *Gandhi* or *E.T.* and are feeling anxious about the output, contact Screenplay Systems, 211 East Olive Ave., Suite 203, Burbank, CA 91502, (213) 843-6557. **—L.M.**

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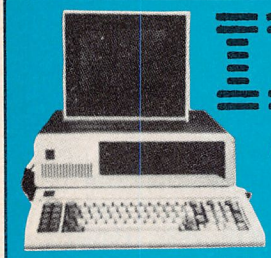

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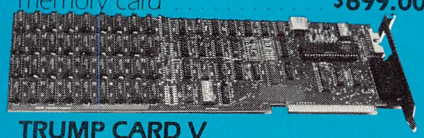

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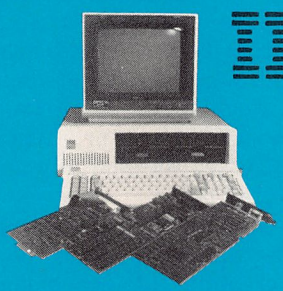

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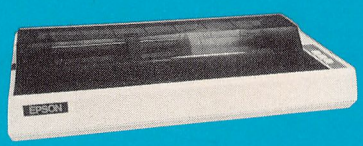

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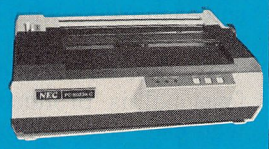

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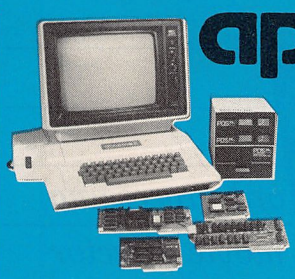

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heavily on TV, we're finding that many customers have sky-high expectations," says Dietz. "Just look at some of the product names: No Problem, Easy Writer, Magic Wand. We have to bring the customers down from the clouds a bit—make them aware of the learning curve they encounter when adapting to computers. But after writers work here, they know what to look for when shopping for their own systems."

Word processors can be liberating for entire departments as well. Most of L.A.'s studios, production companies, and typing services are committed to computerizing their script departments. Susan Johannesson, owner of Hollywood's largest script service, Barbara's Place, finds that employees don't hang around long once they're trained. "Because it's really tough to find and keep good operators, we're adding a Compuscan optical character reader to our system to cut down on operator input," she acknowledges. The Compuscan reader has already saved money at Paramount Pictures' script department. Paramount's Raeann Delpozzo, who helped teach the new coding techniques to the studio's production assistants, says that "we're committed to automating the studio, which means distributed systems serving every department in the long run."

Word processing, says movie director Michael Crichton, is useful, not awe-inspiring. It's just glorified typewriting.

Universal Studios and Warner Communications, active in both film and TV ventures, have plugged scripts directly into their IBM 5520 mainframes. "The Dukes of Hazzard" was the first of Warner's TV shows to automate, and three other series have followed suit. One of those programs, "Love, Sidney," is written and keyed into computers in Burbank, California, and sent via modem to New York for filming. "Learning to deal with artistic temperaments on both coasts was our biggest lesson," says Rosella Sixton, who supervises Warner's word-processing department. "Our hardware worries were just the tip of the iceberg. We also had to take our keypunch operators and retrain them on word processors." Like most script departments at the major studios, Sixton's center runs 24 hours a day, handling revisions at night for the next day's shooting.

Telescripting and Beyond

Unlike some of his peers, television producer Phil DeGuere doesn't dote on the past, those "good ol' days" of "Playhouse 90." He's too busy finding creative applications for today's technologies. Following the debut episode of his ABC series "Simon and Simon," DeGuere got himself a mailbox on The Source and asked subscribers for electronic feedback. The producer's latest high-tech ploy is a proposed series called "Whiz Kids," focusing on the exploits of a 15-year-old computer genius who solves murders with his high school pals.

Another forward-looking TV professional is producer Jerry Juhl, who uses telecommunications software to collaborate with his associates on "Fraggle Rock," a new cable-TV show produced by Henson Associates, the outfit that brings you "The Muppet Show." "I divide my time between Toronto (where 'Fraggle Rock' is shot) and my home in California," Juhl explains. "And the writer I work with, Jocelyn Stevenson, lives in Wales! With a software package called Zterm Professional and a Hayes Micromodem, we send half-hour scripts to one another in less time than it takes to stand in line at the Beverly Hills post office."

For every DeGuere and Juhl, however, you'll find plenty of showbiz techno-reactionaries waiting for systems to crash and for high-tech's true believers to see red ink. They delight in the fiscal setbacks of Francis Ford Coppola, whose Zoetrope Studios in Los Angeles—with its snazzy Xerox Star computer system—is reportedly teetering on the edge of bankruptcy.

Then there are the pragmatists, who insist that despite the amenities offered by computers, humans still have the ultimate responsibility for putting the right words on the page. Even Juhl admits that "when the writing is going well, I wax eloquent about my computer and credit it with encouraging right-brain activity and creativity. But when things go badly, I just hit the damn thing like I used to smack the typewriter."

Hollywood's mixed feelings about the computer are perhaps best captured in a John Riley anecdote. The screenwriter recently demonstrated his computer system to Oscar-winning director Billy Wilder (*Some Like It Hot, The Apartment*) and his collaborator, I.A.L. "Izzy" Diamond, who have offices next to Riley's. The elderly film greats watched with fascination as Riley put the computer through its paces. After he finished, the two men sat quietly for a moment. Then Izzy Diamond blurted, "But it doesn't make the jokes any funnier!" □

Electronic Thinker Toys

Six programs from The Learning Company help children learn to think

by Molly Watt

Designing truly worthwhile educational software for kids is no easy job. To develop programs that are neither too constricting nor too confusing yet still support a child's natural and playful approach to learning requires a formidable understanding of psychology and a mastery of the art of programming. These talents are evident in a series of exciting learning games from The Learning Company, a software firm in Portola Valley, California.

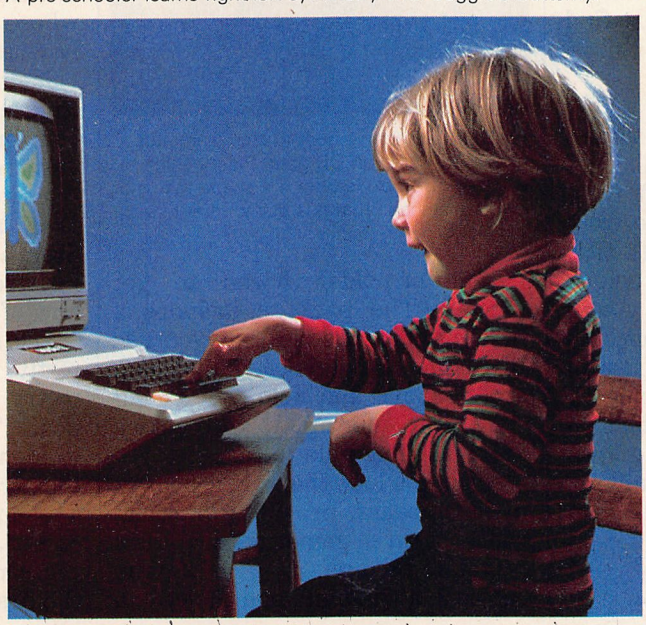
Some years ago the Swiss psychologist Jean Piaget, watching his own children learn, became intrigued with the process. His wonder grew into a lifelong study that has changed the way psychologists and teachers look at childhood and learning. According to Piaget's theories, all children naturally pass through a series of learning stages as they develop. They learn by playing, creating their own ideas about how the world works through a process of trial and error. Children change or enlarge their theories to include new information when the old theories no longer work. And they repeat this process over and over again, well into adulthood.

Perhaps you'll recognize this phenomenon by remembering what it's like to play peekaboo with a baby. Remember hiding your face behind your own hands and then popping back in full view with a "Peekaboo, I see you!" The baby shrieked with delight—you had returned. You played this game again and again until suddenly one day the baby was no longer amused. What happened? Somehow the baby *knew* you were still there even though your face was covered.

Piaget's observations of how learning happens in natural circumstances have helped many teachers and parents understand why it is impossible to simply tell children information about the world. Children need to experiment with information and ideas. They must play with their understanding in increasingly complex situations. Psychologists refer to the process as a developmental approach to learning.

The Learning Company creates software that incorporates this developmental approach. Each of six disks currently available from this firm explores a different area of mathematics and logical problem solving. One disk even demonstrates some of the fundamental concepts of computer science. Using childlike names such as Juggle's Rainbow or Gertrude's Secrets, The Learning Company's activities encourage children to explore basic principles of logic. The challenges on each disk progress gradually from easy to hard and use activities that children find naturally interesting. A child chooses to play with any one activity and explore a particular concept as long as it's engrossing. When new understanding takes hold, he or she proceeds to a more complex problem.

A pre-schooler learns right/left symmetry with Juggle's Butterfly.



Photographs courtesy of The Learning Co.

Directed toward children of various ages, the disks are organized according to specific types of problems. The problems range in difficulty from simple logical concepts like above and below or right and left to complex exercises in logical circuit design that will stump many adults. Directions are clear and easy to follow. Rather than review all six disks superficially, I'll delve more deeply into three of them to illustrate the range and breadth of what The Learning Company has to offer.

The first disk, Juggle's Rainbow, is oriented toward children from ages 3 to 6. It asks them to place objects on the computer screen and to focus on the concepts above and below and right and left. More advanced explorations enable children to explore symmetry and identify the four quadrants of the screen. The second disk, Gertrude's Secrets, is designed to help 4- to 9-year-olds learn to identify and classify objects by color and shape. The third disk, Rocky's Boots, introduces children ages 7 and up to logic gates and flip-flops, concepts fundamental to understanding how a computer works. In the activities on this disk, children build machines based on these logical elements and then use the machines to play arcade-style games. Most adults also find Rocky's Boots challenging.

Juggle's Rainbow

It's almost impossible for adults to remember what it was like not to know up from down, left from right, red from blue, square from triangle. To us it's obvious that above is above and below is below. Yet it's fascinating to young children to discover these concepts and explore their repeated use in increasingly difficult situations.

Juggle's Rainbow lets children do just that. It offers three games for the youngest family members, who will need some help from a parent or older friend to get started. The package includes a blue cardboard strip that you use to divide the keyboard into two areas, above and below. A young child can then play the games without being able to read.

Molly Watt is a freelance writer and teacher trainer living in Antrim, New Hampshire.

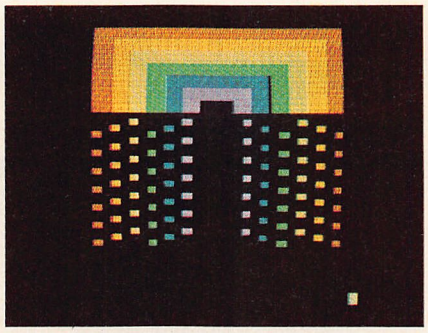


Photo 1: By pressing keys above and below the middle of the screen, children construct Juggle's rainbow.

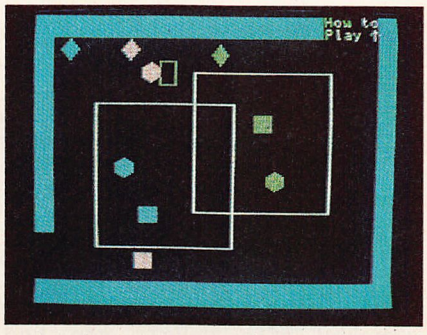


Photo 2: A two-loop puzzle from Gertrude's Secrets. One loop must contain all the green pieces; the other, all the blue ones. The overlapping portion of the figure is empty.

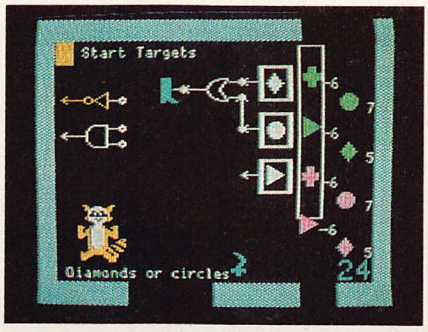


Photo 3: A machine built to kick diamonds or circles. Using an OR gate, the machine will turn on Rocky's boot if a shape that is a circle *or* a shape that is a diamond enters the slot.

After you load the disk, a colorful menu appears, providing a visual choice of three games. Choice 1 is a rainbow; choice 2, a butterfly; choice 3, a windmill; and choice 4, a large question mark. If you choose number 1, you see the word "above" in large red letters in the upper right-hand corner of the screen, followed almost immediately by an animated juggler in the upper half of the screen. Then the word "below" appears in the lower left-hand corner, quickly replaced by a sprawled juggler in the lower half of the screen. Next a blue bar appears, dividing the screen in half just as the blue cardboard strip divides the keyboard.

This first game involves two different kinds of activities. At first you can press any key at all. The computer then displays a colored bar above or below the blue strip on the screen along with the word "above" or "below," depending on whether the key you pressed was above or below the blue strip on the keyboard. After a few turns, the computer challenges you by displaying a dotted bar above the blue strip. The printed words "Now press above" tell you what to do. If you press a key below the line, the computer does not draw anything on the screen but prints instead, "That was below, now press above." If you persist in experimenting with the keys rather than following the computer's directions, the game automatically switches back to the first activity, where the computer reflects exactly what you do.

Juggle's Rainbow, which young children play with real enjoyment, continues to offer challenging variations on this theme. My favorite activity directs you to press any key, as you did in the first activity. But this time the keystrokes build a beautiful rainbow of six colors (see photo 1).

The second game, Juggle's Butterfly, emphasizes right/left symmetry and is somewhat more difficult. The activities ask the child to identify right and left halves of the screen and finally to construct a symmetrical butterfly. The third game, Juggle's Windmill, builds on the concepts and skills learned in the first two games. It teaches the

quadrants of the screen, lets children practice using horizontal and vertical symmetry, then assigns them the final task of the building a colorful windmill. The fourth choice on the menu, The Big Question Mark, is really for adults. It gives specific instructions and provides choices for running the program with or without music and for using picture or word clues.

These learning games let children practice prereading concepts. The games offer an opportunity to classify by position and a chance to use the concept of symmetry, an important aspect of mathematical thinking. A more subtle concept involves what mathematicians call *mapping*, recognizing that one concept—above/below, for example—applies in different domains. In this case, above and below on the keyboard correspond directly to above and below on the screen. Perhaps most important for children growing up in a world full of computers, these games provide an excellent experience in using a computer to make something happen.

Children need to experiment with information and ideas. They must play with their understanding in increasingly complex situations.

Gertrude's Secrets

Gertrude's Secrets, for 4- to 9-year-olds, uses a child's natural interest in color, shape, secrets, and problem solving to focus on important rules of logic. The games are based on an earlier curriculum project, Attribute Games and Problems, developed almost 20 years ago by Elementary Science Study in Newton, Massachusetts, with support from the National Science Foundation.

Gertrude is a goose who acts as a parent or teacher might act. She has a secret that we must discover. She guides us, sets up problems for us, and when we eventually figure out her secret, she rewards us with a prize. Her whimsical role enhances the problem-solving activities by providing a playful sense of continuity to about a dozen individual games and activities.

Gertrude's Secrets uses an adventure-game format where a different activity takes place in each room of a large maze. You choose a game by moving a big green cursor to any room you want. You can roam freely around the maze to select an activity or use the map

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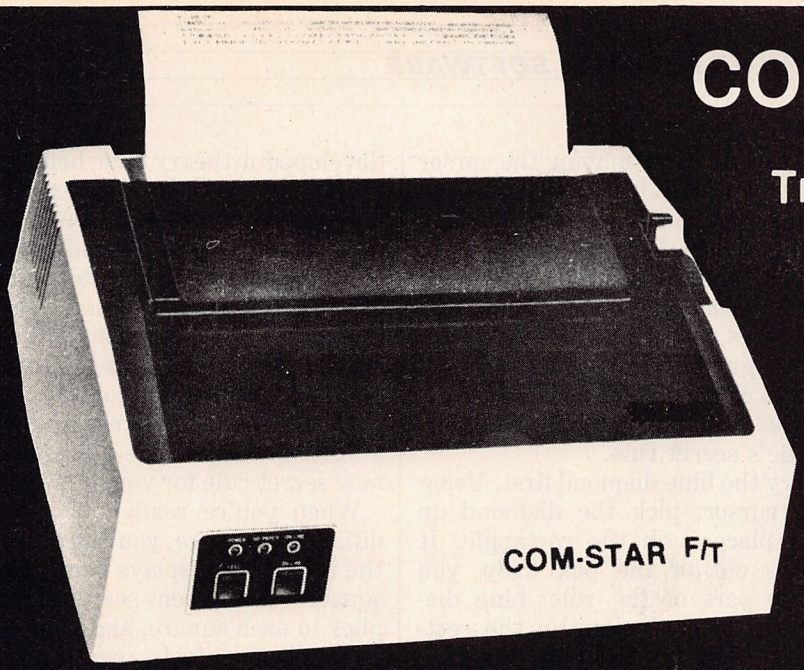

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provided in the instruction booklet to locate a specific room. Some rooms contain instructions and examples showing how to play the games while other rooms contain the activities themselves. A step-by-step tutorial explains how the system works and provides an enjoyable introduction to the activities for first-time users.

All the activities are based on finding the secret rules for arranging and classifying geometric pieces according to their shapes and colors. Loop puzzles (the mathematician's term is Venn diagrams) involve deducing the rules that tell which particular shapes can be placed inside a set of overlapping loops. Train puzzles focus on analyzing the differences between similar pieces. Array puzzles require arranging different pieces in a grid according to logical categories and relationships.

Let's see how a simple loop puzzle works. After moving the cursor to a room with instructions for the game, you pick up Gertrude and bring her back to the game room which contains a single large rectangle. When you release Gertrude, she flies away and returns with nine geometric pieces. Which pieces can be placed inside the rectangle? Your job is to discover Gertrude's secret rule.

Try the blue diamond first. Using the cursor, pick the diamond up and place it in the rectangle. It drops out of the box. Now you know part of the rule: blue diamonds do not belong in the rectangle. Now try the blue hexagon. It also drops to the bottom of the screen. So you say to yourself, "Hmm, maybe *blue* pieces can't go in this box." Then you pick up a violet hexagon and place it in the box. It stays! You continue the process until you have either placed each shape by trial and error or developed a theory that helps you finish the task. In this example, only the *violet* shapes belong in the box. When you've placed all the shapes properly, the walls flash, music plays, and Gertrude flaps in pulling a "You Win" banner and a special prize. Well, this is fun, and you like winning, so you decide to play again. Gertrude returns with a different set of nine pieces and a new secret rule for you to discover.

When you're ready for a more difficult challenge, you can move to the room that displays overlapping squares. A different secret rule applies to each square, and your task is to place objects meeting both secret rules in the overlapping space. Photo 2 shows a finished game. In one box all the objects had to be green; in the other, they had to be blue. Since no shape could be *both* blue *and* green, the shared space was left empty.

To add to the fun, you can go into

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the shape-edit room and change the shape of a game piece or create your own shapes to use in the games. Rachael Stavely, a 7-year-old who tested these games for me, took great delight in creating a smile face with feet. Creating her own shapes was a powerful inducement for her to continue playing the games. Unfortunately, The Learning Company has provided no way to save these user-defined shapes for future games.

Gertrude's Secrets provides hours of fascination for children. The process allows them to develop an understanding of attributes, variables, and classification. However, the process can also be done very well without a computer. I've played these games with young students many times, using colored string and wooden playing pieces that can be ordered from many educational suppliers under the name "attribute pieces." As a child placed a shape in a loop, he also had to state the rule he was testing. One educational saying goes, "If you can describe it, you can solve it." The opportunity to describe a problem is often lost when a child plays the game with a computer. Moreover, in the noncomputer version, some children learned the shapes with their fingertips before their eyes recognized the shapes. The computer version provides no way to incorporate this tactile element.

On the other hand, a computer is never interrupted the way a teacher often is. It never forgets or makes a mistake. It can easily change the rules and keep track of all guesses. And the game pieces are never lost. Many teachers have also found that the noncomputer attribute games take up too much time for the classroom. Yet I find both the computer and noncomputer versions valuable—they complement rather than compete with each other.

I asked my friend Rachael what she thought of this program after she had used it for about five hours. She said, "I think everybody would like this program. You learn about puzzles. You learn what shapes go where. My favorite part is when you get a prize. The hardest part to learn was the train puzzles. You put them together by color and shape. At first it's really confusing. Then you get the idea by watching what happens."

Rocky's Boots

Rocky's Boots is the most complex and innovative of The Learning Company's offerings. Described as being for children "ages 7 and up," the emphasis should be on "and up." Many of the activities here will challenge a sophisticated adult. The game uses a combination of adventure- and arcade-game formats along with some elaborate tutorials to let you explore some of the basic elements used in designing computer circuits. While AND gates, OR gates, NOT gates, and flip-flops are not as familiar to most of us as the concepts of above and below or right and left, they represent fundamental knowledge for a computer age.

The game's main menu lets you choose from six activities, which should be explored in order. The first choice on the menu, How to Move, uses an introductory tutorial similar to the one used for Gertrude's Secrets. One of the nice features of The Learning Company's games is that information learned in one of them—like how to move the cursor around or how to pick up and release objects—is consistent from disk to disk. Even the geometric shapes that are the key elements of Gertrude's Secrets play a major role in Rocky's Boots.

Once you know how to move, you can proceed to the second item on the menu, Building Machines. You'll learn how to combine parts into machines and how to turn them on. The machines work by

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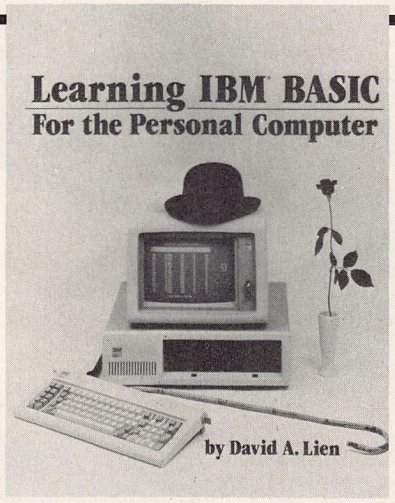

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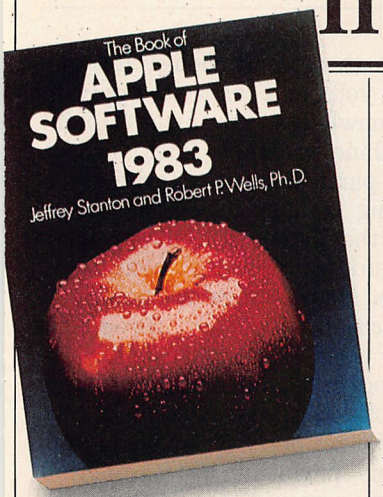

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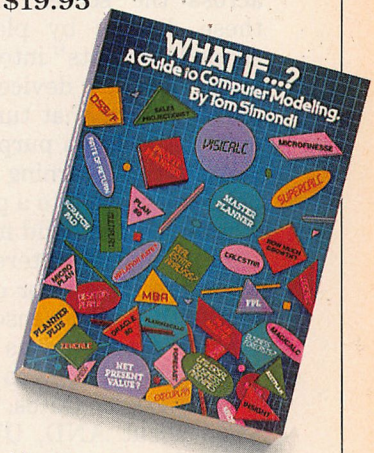

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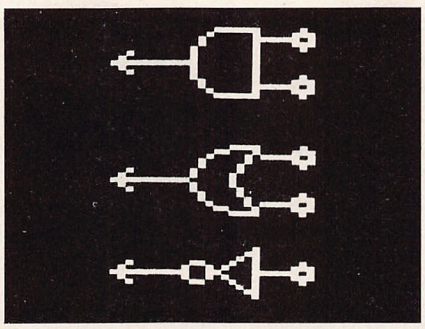
electricity like the lights in your house. But in this game you can see the electric current because it is bright orange. You use electricity to turn on wires and clackers and make Rocky's boot launch a "kick" across the screen. You connect these devices by placing arrow-shaped "outputs" into circular "inputs." Another device you use is a purple sensor that turns on whenever it touches a purple object.

With this learning under your belt, you move into a practice room where you can build machines that turn on and do interesting things when the right color comes in contact with a color sensor.

After practicing as long as you want, you move on to the third activity, Logic Gates, where you learn about AND, OR, and NOT gates (see the illustration on this page). A NOT gate works like this: If the input is on, the output is *not* on. The output is always the opposite of the input. Using this gate with a sensor and a clacker makes a machine that turns on when the sensor does *not* match the color of the piece touching it.

An OR gate can be turned on using either the top input socket *or* the bottom input socket. By now you're beginning to follow the logic, so when you're introduced to the AND gate, you'll probably guess that you must touch both the top *and* the bottom input to turn on the AND gate.



Basic elements of a computer circuit, as used in Rocky's Boots. An AND gate turns on only if *both* of its inputs are turned on. An OR gate turns on if *either* of its inputs are turned on. A NOT gate turns on if its input is off, and vice versa.

After practicing a while, you'll have a chance to use any or all of the AND, OR, and NOT gates combined with clackers, on/off switches, and sensors to create a machine that makes Rocky's boot kick a target. (The game also has a whimsical secret room where you'll meet an alligator.)

With the fourth choice, Rocky's Boots, you get a chance to apply all this knowledge. You have to build a machine to make Rocky's boot kick a particular set of targets in a "kicking gallery" (see photo 3). Here the geometric shapes from Gertrude's Secrets reappear. Several shapes move up one side of the screen, touching three different color and shape sensors as they move. If you've built the right kind of logical machine and connected it properly to the boot, your machine performs by kicking all the blue squares, for example, or all the shapes that are not circles. You're awarded points for all the correct pieces your machine kicks and lose points if it kicks any of the wrong pieces. You can have as many trials as you want for each game and choose from eight different games, each of which requires a slightly different machine.

After mastering Rocky's Boots, you move on to the fifth choice, a tutorial called Flipflops, and then on to the final choice, Rocky's Challenges. This section will really make you sweat and struggle. Fifteen rooms contain all the logic devices you've learned about, the kicking gallery, and 32 increasingly complex challenges. The instructions provide a map to help you find your way around. Building machines to play these games will test your wits, ingenuity, and knowledge as you move from goals like "purple crosses" to "green diamonds or blue triangles" to "circles that come after purple shapes" to games with names like Teri's Teaser or Warren's Widget. The final challenge is to create your own game with your own rules and your own shapes. It's enough to keep you busy for a long time.

A 12-year-old friend, Jotham Stavely, used this program for more than seven hours and is looking forward to spending a good many more. "The best thing about this program," he said, "is that it teaches you some concepts in logic and how to figure them out. It

At a Glance

In General:

Type
Learning games and activities

Manufacturer
The Learning Company
4370 Alpine Rd.
Portola Valley, CA 94025
(415) 851-3160

Price
$45 to $75 (see below)

Format
5¼-inch floppy disks in small cardboard jackets

Computer
Apple II and IIe; contact the manufacturer for information about other computers

Documentation
Small booklets appropriate for children

Specific Programs:
Juggle's Rainbow, ages 3 to 6, $45, prereading concepts and classification skills

Gertrude's Secrets, ages 4 to 9, $75, simple logic puzzles involving shape and color

Gertrude's Puzzles, ages 6 and up, $75, more complex and challenging logic puzzles involving shape and color

Bumble Games, ages 4 to 10, $60, games involving number lines, coordinate systems, and plotting graphs

Bumble Plot, ages 8 to 13, $60, more complex plotting games involving positive and negative numbers and x and y coordinates

Rocky's Boots, ages 7 and up, $75, building logical machines from simple circuits and using the machines to play arcade games

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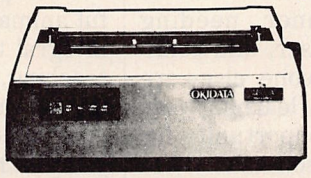

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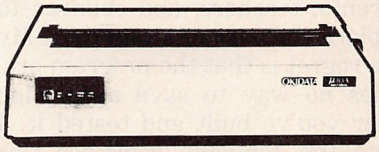

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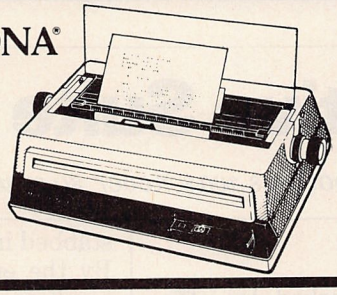

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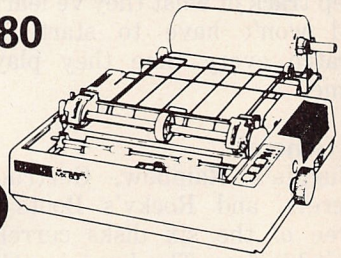

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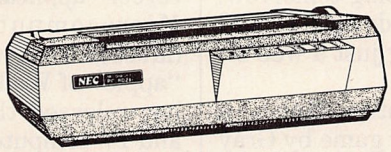

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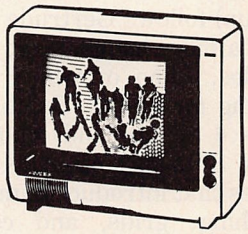

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gives you specific tools to do something. Then you have to make the machines that give you the tools to meet your goals."

With Rocky's Boots, The Learning Company points the way toward an ideal use of computers for learning. The environment that the firm has created is richly endowed with learning experiences. It includes direct tutorials, games that reinforce learning, and opportunities for exploration and invention. The Learning Company has invented a powerful electronic Tinker Toy that opens the door to the computer age. Although adults may not fully understand the concepts involved, Rocky's Boots offers an excellent opportunity for parents, teachers, and children to explore the concepts together. My one regret is that the program provides no way to save a machine after you've built and tested it. I hope the company remedies this deficiency in future products so that children will have ways to keep track of what they've learned and won't have to start from scratch every time they play a game.

In General

Juggle's Rainbow, Gertrude's Secrets, and Rocky's Boots are three of the six disks currently available from The Learning Company. Gertrude's Puzzles (ages 6 and up) follows Gertrude's Secrets with a more complex set of logical puzzles, some of which are challenging for adults. Bumble Games (ages 4 to 10) and Bumble Plot (ages 8 to 13) offer a series of games that introduce number lines, graphing, grids, and coordinate systems.

Each disk is attractively packaged in a cardboard cover that combines the qualities of a record jacket and a favorite storybook cover. Children easily recognize how to put the disks away and do so without any help. I found the packages easy to store on a bookshelf and quick to relocate by the title on the spine.

The booklets that come with the software present simple directions and information about the programs colorfully and concisely. Many children, however, especially younger readers and prereaders, will need someone to guide them through one of these programs the first time. Consider this an opportunity to share in the fun. It may take young children a while to develop the necessary skills for manipulating the pieces and solving the puzzles. But because the programs are clear and consistent, your child may insist on working alone before very long.

Later you may be surprised to find that your child is teaching a friend or sibling. These three levels of mastery—beginner needing help, independent user, and confident helper of someone else—are part of any natural learning process. This multiple opportunity for learning is one reason that these programs have more learning potential than you might think when you first look at them.

As an adult, a teacher, and a teacher of teachers, I wish The Learning Company had provided more explanation about what children are learning through these games and activities. Classroom teachers, for example, may want to know more about how these experiences relate to the standard school curriculum. Nevertheless, the basic information needed to use the programs is provided in a way that is accessible to children, and that's the most important consideration.

All of The Learning Company's software makes excellent use of the computer's capabilities. Tasteful animation, sound, and color are integral to what the programs are teaching. Adults who will be making the purchasing decisions, be advised: take a child with you to show you just how captivating these programs are. □

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by Rachael Wrege

Is your career rocked by office politics? Can't get a handle on where your job is going tomorrow, much less 10 years down the line? Business life getting just a wee bit tedious?

You need Executive Suite, a computerized career game by Gray Flannel Fun, a division of Armonk Corporation. If you're one of those lucky corporate warriors with your very own IBM Personal Computer, just close your office door and start playing—if you've got the courage, that is. Within a few hours, you'll find out if you've got what it takes to rise to company president or if you're headed for demotion to the janitorial crew. You'll rub elbows with vice-presidents and be stabbed in the back by co-workers. By the end of the game, real life won't seem quite so harrowing.

You begin Executive Suite as a career applicant at the Mighty Microcomputer Corporation (MMC), otherwise known as the "apple" of Wall Street's eye. MMC has released the m&m I, II, III, and IV computers and has plans in the works for the Mighty Advanced Design (MAD) computer. Your career objective is to make it to the executive suite as president of MMC, but first you have to scheme your way through an initial job interview, trainee status, middle management, administration, and more.

Rachael Wrege is West Coast editor of *Popular Computing*.

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Executive Suite puts you in a number of situations in which you make decisions that can drastically alter your co-workers' opinion of you. You have to decide whether having drinks with the boys is more important than finishing the work on your desk, learn how to protect your boss, and figure out how to make yourself look good. You'll come up for periodic reviews and have chances to upgrade your position, although the economy, your past decisions, who likes you, and your choice of jobs will all be used to determine your worth.

And speaking of worth, the game has an interesting formula for turning intangibles into numbers. Executive Suite's instructions are entitled "Career Planning Aid" and contain this preamble: "In keeping with a firm belief in capitalism and the free-market system, all rewards and pleasures are monetized according to their relative desirability in the market of human needs and desires." In short, the game gives you a dollar figure on such items as corner offices, titles, loving spouses, and youth. Throughout the game you can see how you're making out by hitting a special-function key for your net lump worth. The listing also pops up every time you're promoted, demoted, or retired.

Illustrated by Niculae Asciu

Because Executive Suite offers only a limited number of multiple-choice responses to the situations it poses, the game's outcome depends a great deal on the department you choose for a starting point. Rising through the ranks, you meet a number of interesting characters—Malcolm Farmsworth III, president; Barney Stone, plant manager; Stuart Snickers, assistant to the president; Conrad Edison, VP of engineering; Peter Hotpoint, skilled assembler; and a cast of some 30 more. All of them will re-

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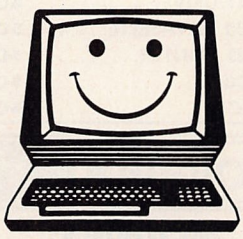

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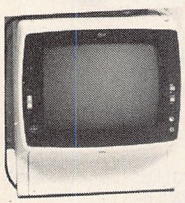

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Throughout Executive Suite, you can use special-function keys on your IBM PC to take a break and save a game (just in case you have some *real* work to do), retire from the company (unless the company retires you), or simply end your career and quit the game. If your flesh-and-blood boss barges in to see why you're laughing behind closed doors, you can hit function key F5 to make the game fade from the screen. When you're alone again, function key F3 restores the game right where you left off.

Executive Suite remembers your name throughout play. Should you be canny enough to make it to the top and oust the current president, you're rewarded with flashy graphics: a newspaper clipping that details your triumph and a picture of the executive suite with your name plate on the desk. □

At a Glance

Name: Executive Suite

Type
Adventure game

Manufacturer
Gray Flannel Fun, a division
of Armonk Corporation
610 Newport Center Dr., Suite 955
Newport Beach, CA 92660
(714) 760-3955

Price
$39.95

Format
5¼-inch floppy disk

Computer
IBM Personal Computer with 64K bytes of RAM (random-access memory)

Documentation
"Career Planning Aid" booklet

Audience
Executives and professionals with an eye toward amusement

TECHNICAL TOOL

Create a Disk Directory

This $25 program keeps track of everything you store on disks

by Robert Moskowitz

Many people fall into the trap of saving computer information they'll probably never use. Because it costs only a few cents per kilobyte to lock this useless information away, they figure why not try to save everything?

Unfortunately, a few bytes here and there, thousands of times over, mount up until you have hundreds or thousands of programs on a whole slew of disks. Don't laugh—I know a man who has more than 5000 programs in his personal collection of more than 500 disks.

Of course, you can lose control over your disks, data, and program inventory long before your collection gets this big. Chances are you have dozens of programs lying around unnoticed, unused. And even if you don't suffer from this particular headache, you're probably putting too much time and effort into keeping track of your programs, disks, and data.

Multi Disk Catalog III, a library file utility program, can give you a handle on your inventory and keep track of many disk files with little effort. It's almost like having an automated librarian take care of your inventory. And the program works so fast you won't spend a lot of time using it. For example, I used Multi Disk Catalog III to record the directories of 22 disk sides containing dozens of programs each in just 4 minutes 11 seconds.

Robert Moskowitz is a business consultant who lives in Woodland Hills, California.

Multi Disk Catalog III requires only a few minutes each month to track an almost unlimited number of programs on disks using Apple DOS (disk operating system) 3.1, 3.2, 3.2.1, or 3.3. The program works by reading disk directory information and creating a database of disk identification numbers and file names, types, and sizes. You can also key in special two-letter classification codes for each file. Or to help yourself remember the contents of particular disks, you can give each side of the disk a title up to 26 characters long. The program provides printed or on-screen lists of your data files and sorts many possible combinations of information with the economy of operation you wish every computer utility had.

The program's biggest problem is that it only reports on the disk files you have; you need other programs if you want to move or delete files. At first I wished that Multi Disk Catalog III were part of a comprehensive utility that also included a file development capability and a disk scanner and editor. But the program does plenty of useful work as is. At $25, it will probably pay its own way in the first six months simply by helping you reclaim several disks' worth of space now occupied with files you don't want or with unnecessary duplicates and triplicates.

Simple Commands

Using Multi Disk Catalog III is easy—most of the operations are controlled by single-key commands. For example, the program reads either 13-sector or 16-sector disks on any 48K-byte Apple II or IIe with any Apple DOS; to switch between the two disk patterns, you just press the F key. To abort your current operation and get back to the main menu, you press the Escape key. Pressing N clears the memory for loading or for reading a new set of file names.

Another single-key command that's useful is A, which instructs the program to read the directory

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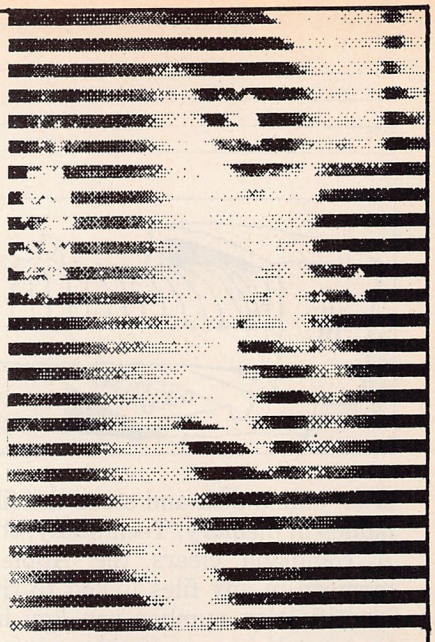

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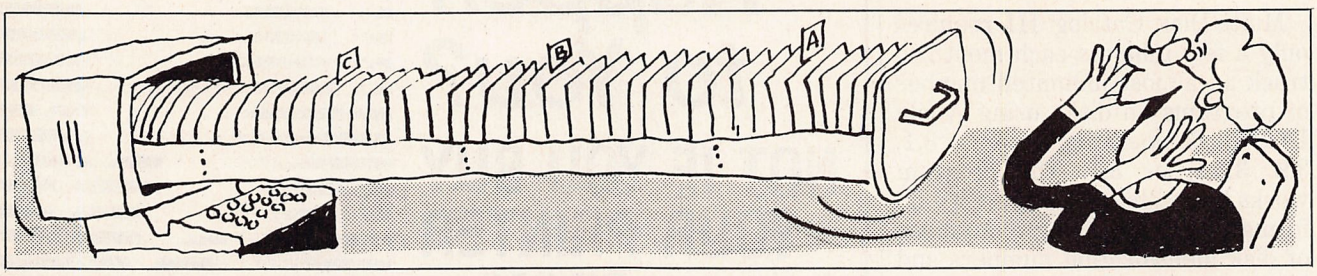

of an online disk and store the file names in memory. Technically, the A command clears the Apple's memory of any files linked to the identification number you key in, then reads in new directory information from the current disk. If you're reading a disk for the first time, this delete-and-add process simply stores the new information. But if you have an existing database of file names, this command is an effective way to update or revise it.

Finally, lest you think mistakes are a serious danger, nearly every function provides prompts and requires confirmation.

Classifying the Data

Once you've stored directory information in memory, you might want to classify it for easy sorting. To do so you press C to enter a special classification routine. Here Multi Disk Catalog III prompts you with one file name at a time and asks you to provide a two-letter classification code. You can classify the entire database of file names at one time or search for certain groups of files and classify just these. A built-in menu lists 11 suggested categories for first-letter codes (including Business, Education, Game, and Word Processing), as well as 10 categories for second-letter codes (including Adventure, Correspondence, Math, and Utility).

Although you can't change these suggested classification codes, which appear on the display as you work, you can ignore them and use any code combinations that make sense to you. You can also delete single files from the database during this classification process by us-

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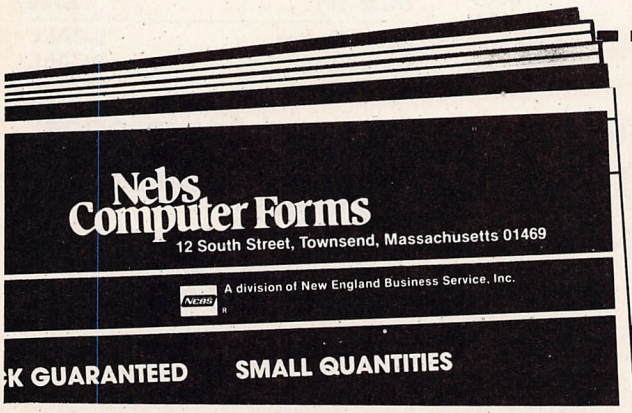

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ing the Z (for Zap) command, which you'll probably find most useful for eliminating unwanted listings of Hello programs from large databases.

To key in a title for each disk identification number, you press T. The program lists the title along with the file names in the database. However, the title is intended only to help you remember the contents of the disk; you cannot use it in computer searches within the program.

To sort a database, press O (for Order). Then you can sort on any one, two, or three factors in the listing: file name, disk identification number, file size, classification code, or file type (Applesoft, binary, integer, or text). The sorting is unbelievably fast—the program sorted a database containing 526 names in 9.8 seconds. And when I added a second and third sorting factor, I didn't notice any change in speed.

Each separate database can contain up to 950 file names. If you have more files than this, you can list some disks in one database, some in another. However, you cannot sort more than 950 file names at one time. Incidentally, sorting is the final step in deleting any file names from a database. Although the names you delete disappear from the output immediately, they remain in the program's memory. When you sort the database, the program compresses the memory to eliminate the remnants of all the file names you previously deleted.

To let you know when sorting is taking place, the program generates a "sort noise" by clicking the Apple speaker each time a file name is moved. As the sort proceeds, the clicking sounds like a rapid-fire staccato and finishes as a high-pitched chirp. You can press Q from the main menu to quiet the noise, but you can't turn the noise on again without rebooting the program.

At a Glance

Name
Multi Disk Catalog III

Type
Library file utility program

Manufacturer
Sensible Software Inc.
6619 Perham Dr.
West Bloomfield, MI 48033
(313) 399-8877

Price
$25

Format
5¼-inch floppy disk

Computer
Apple II and IIe with disk drive

Documentation
16-page booklet

Audience
Anyone who needs to assemble, sort, search, and print lists of their disk files

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IF YOU'RE CONFUSED PERSONAL COMPUTER,

At this moment, there are no less than 50 personal computers on the market. And more are being introduced every day.

On one hand, having all those options is a good thing. On the other, it can make picking the right one pretty difficult.

Computers come in two parts. You have to buy both.

We'd like to help. So here are a few suggestions about how to buy the computer that's right for you.

Computers come in two parts.

One part is the "hardware," which is the machinery itself. The other is the "software," or a program, as it's sometimes called.

Software is the part that tells the computer what to do, the way a driver tells a car what to do.

Without software, a computer can't do anything.

And vice versa.

You have to buy both.

Buy the software first.

Since the reason you're buying a computer is to get the capability the software gives you (remember, it's the software that knows how to get things done), it makes good sense to pick the software first.

Start by making a list of the things you want to use the computer for. It can include almost anything—any kind of inventory, filing, accounting, graphics, reporting, record-keeping, analysis—you name it and there's probably a software program that does it.

Next, take the list into a computer store and ask the salesperson to give you a demonstration of the program, or programs, that will do the things you want.

Even though you'll need a computer for the software demonstration, keep in mind the computer is just a vehicle. The software is the driver. And once you've decided on the software, picking out the rest of the computer system will be much easier.

The simpler the better.

Look for software that's easy to learn, easy to use, and that does the job in the simplest way possible.

Good personal software should be, as the computer people say, "friendly." Meaning that it helps you do what you have to do without getting in the way.

Meaning there are no complicated routines to follow to perform a simple task. And no programming language to learn.

Some people, however, will tell you that software has to be complicated to be powerful.

Nothing could be farther from the truth.

Because in order for a program to appear simple to you on the outside, it has to be extremely complex on the inside.

ABOUT BUYING A HERE'S SOME HELP.

Good software keeps the complications in the computer, where they belong. And keeps the capability at your fingertips. It's that simple.

You simply have to see for yourself.

You can read any number of interesting books and magazines about personal computers. You can ask friends who have them. You can look at all the sales literature you can get your hands on. And you should do all those things before you decide to buy.

But as helpful as all that can be, there really is no substitute for a real, live demonstration.

When you do go out shopping, we recommend you take a look at the PFS® Family of Software.

The PFS family is designed the way we think all software should be: simple, straightforward and powerful.

Currently, three products make up the family. PFS:FILE, PFS:REPORT and PFS:GRAPH, with more programs on the way. Here's a little more about each of them.

PFS:FILE. The simplest way to get organized.

Basically, FILE works like a paper filing system, without the paper. So you can record, file, retrieve and review information in a fraction of the time it takes with a conventional filing system.

FILE lets you arrange your information in "forms" you design yourself. So you can get at and really use your information in ways never before possible.

What's more, FILE lets you change the original form without having to redo the information on it.

PFS:REPORT. Making the most of your information.

REPORT summarizes the information on your forms so you can use it to analyze, plan and make better-informed decisions.

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PFS:GRAPH. Instant pictures.

GRAPH gives you presentation quality bar charts, line graphs, and pie charts, in black and white or color, on paper or the computer screen. To get a clearer picture of things and spot trends instantly, you simply enter your information and specify the kind of graph or chart you want. GRAPH does the rest.

You can also mix and match line and bar graphs, or even stack or compare up to four bar graphs simultaneously.

And GRAPH will work with PFS:FILE, VisiCalc® files, or data entered directly into the computer.

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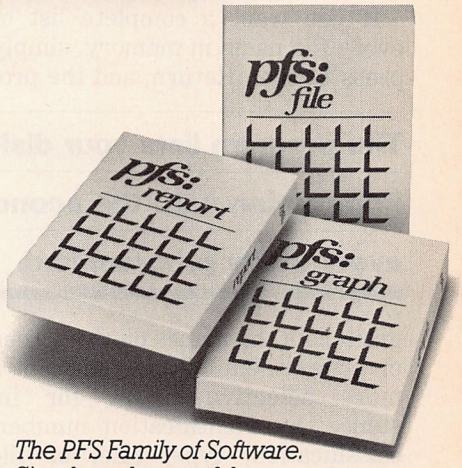

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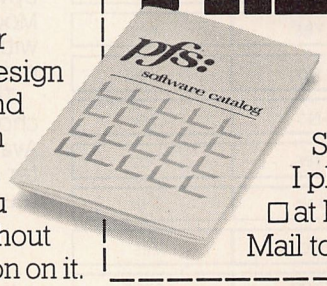

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Examining the Output

If you want a complete list of every file name in memory, simply press L, then Return, and the program lists the names on the screen or prints them out. If you want a more selective listing—for instance, by identification number, classification, type, size, or file name—you simply type in the appropriate abbreviations. It's a fast, easy way to specify what you want to find.

However, unlike most search systems, this one works column by column: the columns of the characters in the search must exactly match the columns of the characters in the listing. This requirement is a definite limitation. For example, if you want to see programs ending in .TEXT, you're in trouble. Because the .TEXT ending can occur in almost any column under the file-name category—depending on the length of the root file name—the computer cannot search for that or similar endings within Multi Disk Catalog III. You must display the whole list and search the file-name entries by eye. This process is cumbersome, particularly when you have 500 files or more.

The program lists your disk files and sorts information with the economy of operation you wish every utility program had.

All listings—whether a full list or the results of a search for some particular value—are automatically sent to the screen. If you want a hard copy, you must first hit P and then key in the printer slot number when prompted. When you're finished printing, press P and then zero to reset the output to the screen.

All in all, the program's listing capabilities are weak, neither very fast nor very fancy. A simple 40-column printout looks just like the display you see on the screen, with a single-character left margin that looks downright primitive on paper. The program also wastes time printing any spaces left in the directory entries after the file names and does not bother to count lines for top and bottom margins on a page. However, you can format pages yourself: you just count lines and switch the listing on and off with the space bar. But this process is both tedious and time consuming.

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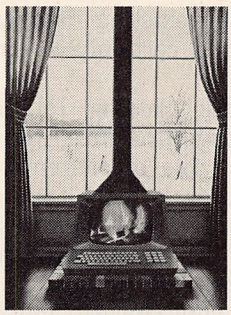

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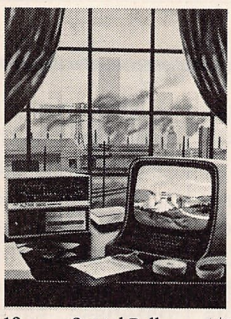

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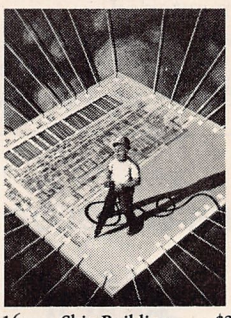

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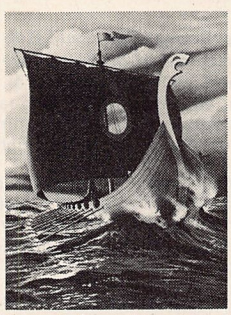

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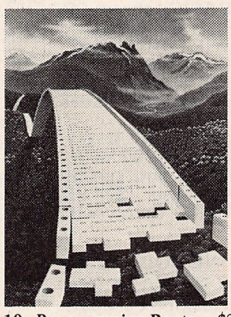

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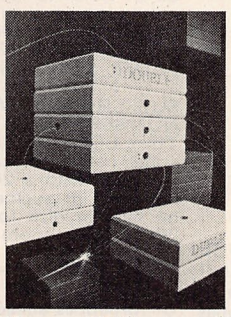

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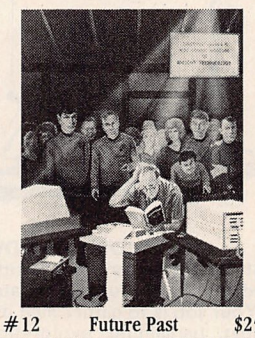

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Single-Purpose Software

In practice, Multi Disk Catalog III is much faster to use than to explain. Response is almost instantaneous, and the thorough prompting makes the program easy to use, even if you skip a month or more between working sessions. One convenient feature even allows you to store a database on a disk that uses the same operating system the program is set up for; this means you can save your directory right on one of the disks you have just inventoried.

I was disappointed, however, when I wanted to delete a redundant file or run a program to see what it does and found that I could do neither from within Multi Disk Catalog III. The program is strictly a file directory, nothing more.

The program does only one thing: record and track computer files. But it does this exceedingly well.

Also, you should be aware of a few flaws in the program. First, it provides no easy way to check the amount of space that remains on the disk you're currently using. To find out how much space remains, you must add the disk to the database, save the database, and then read the amount of available space from the listing. Consequently, it's easy to save a database on a nearly full disk and thus lose the overflow information. Moreover, Multi Disk Catalog III gives you no warning when the disk is full, and the program continues to function normally even as you're losing the overflow data. You may never realize you threw away your data until later, when you reload that database and find that it lists only some of the disks. Finally, the program needs no confirmation to overwrite an existing database, a requirement I certainly consider a necessity.

Multi Disk Catalog III comes with a 16-page brochure, including a detailed table of contents. The documentation is more than sufficient because the program is so logical, so self-prompting, and so single-purpose in design. It does one thing only: record and track computer files. But it does this exceedingly well. I can recommend the program as useful, well written, and a valuable investment for anyone with more than a dozen or so computer disks. □

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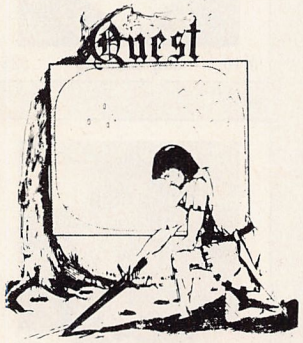

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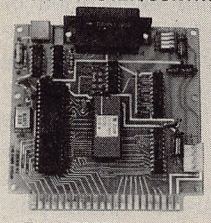

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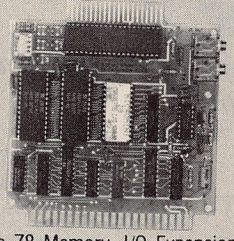

The Z8 Memory, I/O Expansion & Cassette Interface Board (Z8 Expansion Board for short) allows you to add up to 8K of additional memory plus three 8-bit parallel ports to your Z8 Basic Computer/Controller. The memory expansion will support any combination of byte wide RAM memory chips or 2716 or 2732 EPROM. The cassette interface is 300 baud Kansas City Standard (2400Hz/1200Hz).

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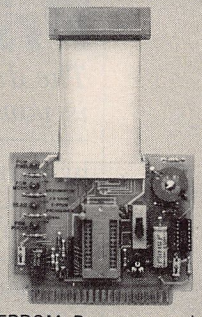

The EPROM Programmer board allows you to transfer application programs in BASIC or Assembly language directly from RAM to either 2716 or 2732 EPROMS. Requires Z8 Basic Expansion Board for operation.
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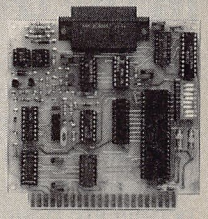

The Serial Expansion Board adds an additional RS-232C serial port to the Z8 system. It runs at 75 to 19,200 baud in all standard protocols. The 20 ma. current loop is opto-isolated for reliability and protection.

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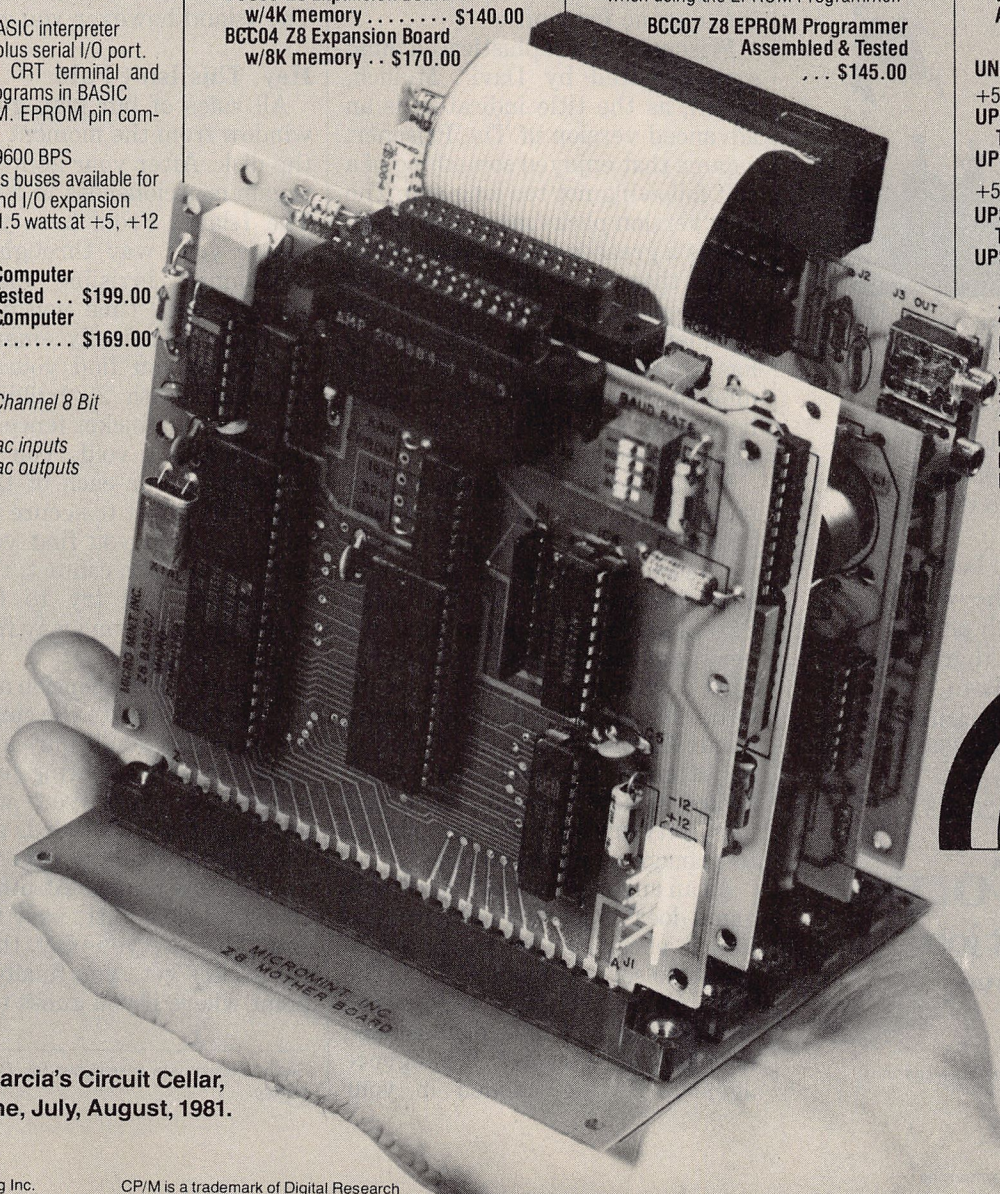

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GAMES

Prisoner 2

The diabolical game where trusting no one is your only way out

by Susan Ferber

If you're a typical video-game player—the kind who salivates at the mention of Pac-Man or Donkey Kong—you needn't read on. If, on the other hand, you're tired of the same old shoot-'em-up, eat-'em-up, rack-'em-up stuff and you're an adventure-game fanatic who will do anything to win—even lie, cheat, steal, and murder—then Prisoner 2 is the game for you.

Prisoner 2 is a sophisticated mind game created by David Mullich, which, as the title indicates, is an advanced version of The Prisoner, a game that enjoyed something of a cult following not too long ago. The new version packs more action and places a greater emphasis on social satire than the original. Even the documentation contains its share of commentary, tracing how society has changed from the politically minded sixties to the technologically minded seventies to the video-game-crazed eighties.

Mullich admits the game was inspired by *The Prisoner* TV series. "But," he says, "the game is written more as a piece of literature. For instance, if you've read Orwell's *1984*, you know that it's very unpleasant, anger-provoking. That's what this material is meant to be. It's not intended to be just a game. Certain issues are raised in an attempt to make the player aware of how various institutions in society try to make us conform to manage us more effectively."

As an anger-provoking piece, this game does its job well. The frustration it elicits can be compared to trying to solve Rubik's Cube in the dark. When the game begins, you assume the role of a disillusioned member of a secret intelligence agency. Having handed in your resignation, you are presented with nothing more than a three-digit code which, as the documentation explains, is an encryption of your reasons for leaving. You are then abducted by unknown forces and taken to an isolated community known only as The Island. The computer is now your captor. Its goal is to obtain your resignation code through whatever means possible. Your goal is to escape from The Island however you can.

Hey, This Isn't Fair

All rules of fair play go out the window from the moment you boot the disk. After your abduction you regain consciousness in a castle on The Island. From here you must weave your way through a time-consuming, invisible maze that changes each time you encounter it. When you finally emerge from the maze, you find yourself in a courtyard with 20 buildings surrounded by a picket fence. Outside the fence is a void. You must attempt to enter each of the buildings in an effort to secure the clues that will help you find your freedom. Your main contact, the seedy Caretaker, will try to foil your plans and lead you away from your goal to escape.

Trickery and deception await you in each building. In the courthouse, for example, you'll play a game of hangman with a leering judge who sometimes gives you words to guess that are not words at all. All the letters you try, even all the vowels, are wrong. At other times the words are fairly easy to guess. But the more you play, the higher the stakes get. You finally reach a point where if you guess the word,

Susan Ferber is a researcher for *Popular Computing*.

you win a lot of points that you can use to obtain clues. But if you fail, the computer threatens not only to take away all your points but to erase the entire game from the disk. When I saw that, I chose to opt out of the game. But the computer paid no attention and made me play anyway!

In the hospital, you'll become involved in a word-association mind game through which the shrinks try to manipulate you into giving them your code. The thing to remember is that no matter what is presented to you, it should never be taken at face value—hidden motives lurk behind everything.

At times you'll be sent on tedious missions that seem senseless to you, and indeed they are, for at the end of the mission you find yourself back at square one. At other times the computer appears to suffer from programming bugs and errors. These are just some of the Caretaker's many ways of getting you to tear your hair out and submit to the pressure by revealing your resignation code.

Believe No One

By all standards, Prisoner 2 is unique. Mullich has created an ingenious and diabolical nightmare of colorful, high-resolution graphics and scathing, mind-boggling tricks. This game is not for the easily frustrated or the impatient. In fact, rumor has it that the CIA has used the game in selecting recruits. Does that tell you anything?

When playing the game, bear in mind that on The Island there are no rules, no set patterns, and little or no logic. You should believe nothing you are told, act against your better judgment, and trust no one but yourself. Following my advice, however, is no guarantee that you'll succeed. After all, I may be working for them. □

At a Glance

Name: Prisoner 2

Type
Adventure game

Manufacturer
Edu-ware Services Inc.
POB 22222
Agoura, CA 91301
(213) 706-0661

Price
$32.95

Format
5¼-inch floppy disk

Computer
Apple II and IIe with 48K bytes of RAM (random-access memory)

Documentation
13-page booklet

Audience
Adventure-game fans and those fond of brain teasers

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ISO-1

ISO-2

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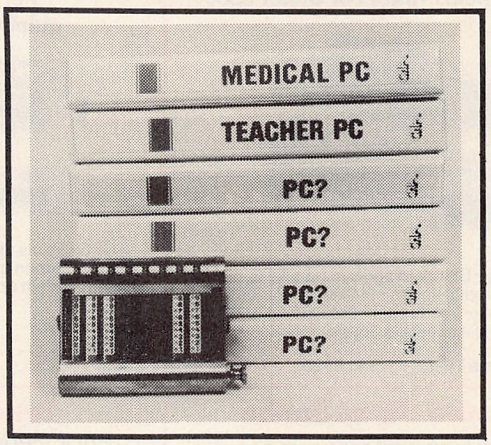

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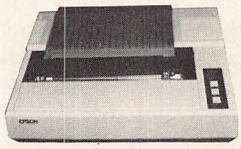

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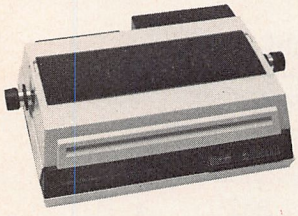

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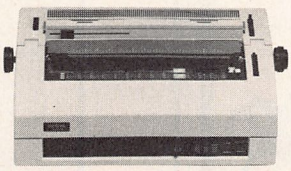

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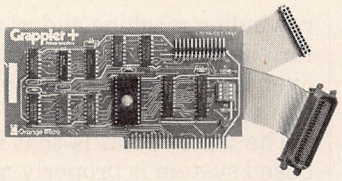

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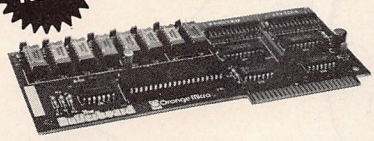

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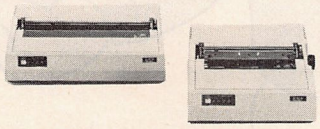

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A wide-ranging look at ways to get more from your personal computer

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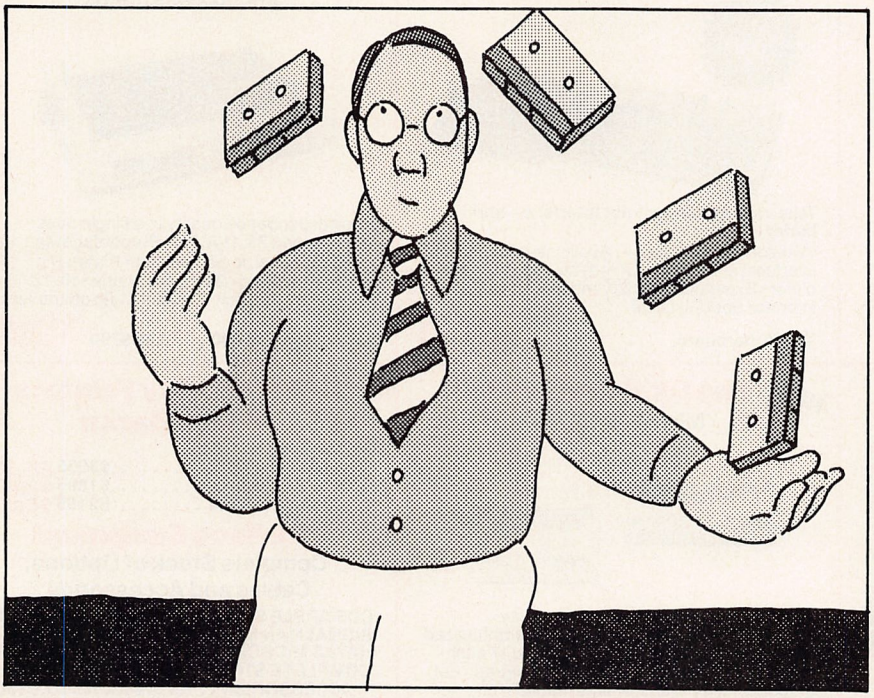

Getting Along with Cassette Storage

The cheapest form of mass storage for a personal computer is the audio-cassette recorder. Despite the clear advantages of a disk-based system, many people own tape-based systems simply because they cost less.

Granted, you often hear horror stories about tape-based systems. But by following a few simple rules, you can accomplish a great deal of useful work regardless of the system you use. I use a 48K-byte TRS-80 Model III, a Radio Shack CTR-80A cassette recorder, and an Epson MX-80F/T printer. I write with the Scripsit word-processing program (on tape) and do my programming with the ROM-based Model III BASIC. I also keep a second cassette recorder handy, which I use as a rewinding machine and as a backup for the first drive. (Occasionally, I even put a genuine *music* tape in it.)

The whole point is that if a tape-based system is properly managed, it can be fully as reliable as a disk-based system. Furthermore, despite the severe limitations of a tape-based system, my experience has shown that it is possible to use such a computer system for worthwhile work. I first used mine to write a 500-page dissertation and a data-analysis system to process the tables for it; since then I have been using it for personal finances, freelance writing, and software development.

What kind of cassette recorder should you use? In general, it's a good idea to use the machine made or supplied by the computer manufacturer. For example, on a TRS-80 system, it's best to stick with the CTR-80A. If you have problems on a system all from one company, that company cannot pass the responsibility on to another.

Some features you will want your recorder to have include a tape counter, a volume control with easy-to-read settings, and an AC power supply. Beyond that it's wise to follow these seven rules for getting along with a cassette-based personal computer system:

- **Use high-quality tape.** Good tape is vital because of the severe demands placed upon it. Most

Illustrated by Patrick Blackwell

systems run at either 300 or 500 bits per second (bps), although the TRS-80 Model III has an optional 1500-bps cassette output. Audiocassette recorders generally run at 1⅞ inches per second; this means that at 300 bps, 1 bit occupies about 0.00625 inch; at 500 bps, 0.00375 inch; at 1500 bps, 0.00125 inch. Now, any tape fault that approximates the size of 1 bit stands a good chance of ruining the tape file recorded over it. Actually, a tape fault considerably smaller than that stands some chance of messing things up. Of course, higher-quality tape is more expensive, but with audio tape you get exactly what you pay for. While it's true that we bought a tape-based system to save money, inexpensive tape can be of such poor quality that it is not usable for our purposes.

Most cassette recorders intended for personal computer systems are designed to use low-noise, high-output tape. This means that the bias and equalization of the recorder have been adjusted at the factory to produce the best results with such tape. For this reason, using chrome, ferrichrome, or any other kind of specially formulated tape will probably not improve your system's performance. Using such tape may in fact reduce performance if the bias and equalization settings in the recorder are sufficiently far away from the bias and equalization the tape is designed for.

The best tape for most home computer systems, then, is a high-quality, expensive, low-noise, high-output tape. I use Maxell LN tape, but several different brands of tape fit the description.

It is worthwhile to test three or four brands on your system. However, once you've found the brand that gives you the best results, stick with it. If you are consistent in your choice of tape, you eliminate one source of potential problems.

•**Never use the first minute of tape.** This rule has been gospel in the audiovisual world ever since cassettes first came on the scene. In the course of the normal life of an audio cassette, the ends of the tape tend to get a bit mangled. If you carefully examine the first few inches of even the best new cassettes, you will often find creases, abrasions, and other faults created by the stresses the tape undergoes during manufacture, shipment, and storage. Obviously, faults such as these make using the first minute of tape very risky.

The simple way to apply this rule is to put a tape in your machine, set the counter to zero, play the tape for one minute, and then note the counter reading, which becomes the starting point for the tape. Don't even bother trying to record anything before that point. For the same reasons, avoid using the last minute of the tape as well.

•**Always use new tape.** This may sound like madness, but in fact it is not difficult to do. It doesn't mean that you need a fresh cassette every time you want to save something. What it does mean is that each new file is recorded head-to-tail after the previous one. In that way, each file is on a portion of the cassette that has never been used before.

Using the techniques described below to create a logbook of your tape files makes it unnecessary to record over existing material. You can permit yourself to reuse an old tape after completely erasing it—never try to rerecord in the middle of an existing file.

•**Take care in setting the volume control.** Setting the volume control is one of the great bugbears in using a tape-based system, and it pays to be scientific. Usually the problem is not in recording but in playback. The trick is to find a volume level that will consistently give you reliable storage.

To experiment with various volume settings, first try saving a fairly substantial program. It needn't be a program that will actually run, but it does need to be easy to check. One could, for example, use a program that consisted of about 30 repetitions of the same line. That will give you about 1800 bytes to save, which is enough to provide a realistic test but not so much that it takes all day just to run this one test.

Put a new tape into the machine. Fully rewind the tape and set the tape counter to zero. At a point at least one minute into the tape, write down the counter number where you will start the save. Now save your program (in TRS-80 BASIC, that means using the CSAVE command) and write down the counter number at the end of the save.

When the save is complete, rewind the tape to a point about two counter numbers before the start of the save. Set the volume all the way down. Try to verify the save (in TRS Model III BASIC, you'd use the CLOAD? command). Keep trying, raising the level slightly each time, until you find the minimum level that gives you a verifiable save.

Now try to verify the save again. If your results are positive, try once more. If you still get verification, you're in good shape and can go on to the next rule. If you're not getting verification, check all the connections and try again. If it fails again, assume that the volume setting is still too low. Continue to increase the volume until you have established a range of volume settings that consistently produce a good save/verify sequence. If you can't get consistent verification at any volume setting, repeat the process using a different cassette tape. If you try two different cassettes at a variety of volume settings without getting consistent saves, you probably have a hardware problem.

Once you've found the appropriate volume setting, note or mark that setting and use it *every time* you load a program. By being consistent in using new tape of the same brand on the same machine at the same volume setting, you will have eliminated a number of potential problems right from the start.

Furthermore, if you do have problems, you know several things that aren't causing the difficulty. That makes it easier to track down the gremlin.

•**Keep a written log.** This is essential to creating and maintaining a systematic set of tape files. Remember that tape files are essentially sequential in nature. There is no such thing as random access on a tape; you have to go past each file between where you are and the file you want to reach.

This, together with the fact that we will in general use nothing but new tape, means that our tapes will be organized chronologically. The files we create today will be found after the files we created yesterday and before the files we create tomorrow.

To keep useful records, it's essential that your log includes the name or description of the file, the date the file was created, the tape on which the file is located, the tape-counter number where the file begins, and the next available counter number on that tape. Mind you, each file on each tape is an individual unit. For example, if you have six versions of your checkbook program on your system, then you must individually record the filing information for all six of those files.

•**Fully rewind and set the counter to zero.** In order to keep your records accurate, you must use some system for keeping your tape-counter numbers consistent. This means that each and every time you put a cassette into the recorder, you must fully rewind the tape and set the counter to zero. Once the counter is set, don't touch it again until you put in a new tape; then you must reset it again.

•**Always check the tape before a save.** Follow this simple procedure to make sure you aren't about to erase something valuable. Rewind the tape, reset the tape counter, and unplug the cable from the recorder. Play back the tape at the spot you intend to use as the start of your next save—if you don't hear anything, you are on blank tape and may go ahead and save your program at that spot. Don't rewind before you do the save lest you rewind too far. If, on the other hand, you hear a loud buzz when you listen in, you are in the middle of a tape file and something is wrong. Probably either your records are off or you didn't reset to zero properly.

Of course, this works only if you always use new tape. If you've got a tape full of files and you're trying to stick something into the middle of it, you'll never be sure where you are and the disaster you create will be all your own.

—Robert W. Bethune

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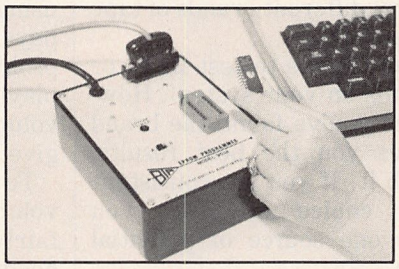

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The Database—A Modern Fable

Once upon a time, in the land of corporate data processing, there was a big mainframe computer that whirred and hummed in its own air-conditioned lair. Computer operators fed it long reels of magnetic tape that had names like Personnel File and Payroll File. In response, the computer would disgorge reams of printouts, payroll checks, and form letters.

But in the realm of the users—the people who relied on the computer's information—all was not well. When a user wanted information in a new form, the programmers would shake their heads and say, "But the system isn't set up that way. It would take us weeks to get that to you." And the users would murmur, "What good is all that computerized information if we can't use it?"

And it came to pass that the demon of data redundancy arrived to plague the land. Different departments collected the same information for different data tapes, and the keypunch operators punched and repunched the same data many times. When discrepancies appeared (in an employee's salary scale, for example), no one knew which tape had the right data.

And then the bright, young computer science graduates and their teachers thought of a solution. They called it a *database*. Instead of being stored on many separate reels of tape, a company's data would all be in one place, usually on a high-capacity magnetic disk. To build the database, they developed *data structures* to allow each piece of information to be stored only once, thus banishing data redundancy once and for all. Then they created tools to put the information at the users' fingertips, and they called the package of such tools a *database management system*.

Large companies saw the many advantages of these systems and bought database management packages with names like TOTAL, IDMS, and ADABAS. There was sunshine in the land of corporate data processing (although, of course, "happily ever after" is only in fairy tales). Database became a term with prestigious overtones, implying efficient information management and full exploitation of the corporate computer as a business tool.

When the microcomputer age dawned, it wasn't long before software vendors began offering database management systems for personal computers. But in the translation from the mainframe to the microcomputer, the terminology has gotten a bit fuzzy. Vendors have been using the term to mean almost any system that turns a microcomputer into an electronic filing cabinet.

Microcomputer database management systems range in price from $10 to $3000, and as you might expect, they vary widely in power and ease of use. Most of them allow data entry and retrieval and permit some data manipulation, such as sorting or selection of information meeting some criterion, like "all accounts 30 days past due." But except for the systems in the $500-and-up category, microcomputer database software is closer to the magnetic-tape filing systems of yesteryear's mainframes than it is to modern mainframe database management systems.

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File Management

On the lower end of the price scale are the file managers and the index-card type of database systems. An example of an index-card system is Visicorp's Visidex. It allows you to type in text as you would with a word-processing program and then to index each page (or, more correctly, to *screen* each page with a number of keywords). The computer can then find and show you all of the screens with the same keyword, such as all recipes filed under "ground beef." If you wanted all recipes that mentioned milk but had neglected to select milk as a keyword, you can use a slower search function to find the desired recipes. Visidex can also print mailing labels in, say, zip code order, if you have specified each zip code as a keyword when you entered date.

With a file manager, you organize your information in computer *files*, roughly analogous to file folders in a filing cabinet. You would have separate files for personnel, payroll, customer orders, suppliers, and any other categories you might need. Data entry is more structured than in an index-card system. Usually you design the forms that will appear on the screen, at which time you fill in the blanks with your data.

Popular file managers include Stoneware's DB Master, Visicorp's Visifile, Innovative Software's T.I.M., and Software Publishing Corporation's PFS. Such systems are usually *menu driven*, with prompt screens that guide you from one function to another. Most feature sorting and searching capabilities, password protection for sensitive information, and a report-writing function that allows you to extract information in a variety of formats. File managers also typically have some built-in data-checking capabilities (such as requiring numbers to be entered when a dollar amount is needed) as well as the ability to do modest calculations.

The major drawback of a file manager is that the system can work on only one file at a time. If your information needs are fairly complex, a file management system might leave you the same problems that plagued the land of corporate data processing in our fable about mainframe computers. You might find yourself duplicating data in different files or having difficulty combining your information in new and different ways.

More Power

Some packages that offer a solution are *multifile* systems, like FMS-80 by DJR Associates Inc., and *relational* database systems, like dBASEII by Ashton-Tate and Condor Series 20 by Condor Com-

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puter Corporation. Such systems enable you to extract information from a number of files and thus begin to approach the power of mainframe database systems.

In most multifile and relational packages, you control the system by typing in commands rather than by making selections from a menu. This gives you more flexibility and greater speed, but it can be harder to learn. The commands controlling an extensive information system are almost as complicated as a computer program. In fact, commercial software developers have used such packages in place of computer languages to generate complex programs such as accounting systems.

On the very high end of the microcomputer database price scale are the systems that actually duplicate most of the capabilities of mainframe systems. Like their mainframe counterparts, these require custom programming in a language like Pascal, BASIC, or COBOL. An example is MDBS by International Software Enterprises Inc. Instead of using files, MDBS uses the hierarchical network data structure popular in many mainframe systems to store each piece of information in only one place.

Variable-Length Records

This can be a big advantage if your data would fit in what programmers call *variable-length records*. An example would be a list of students, each with a different number of classes. Should you provide enough empty space in your file for each student to take, say, 10 classes, and thus waste space for those who take fewer? The network structure solves this problem because it stores information not in files but in smaller units called records, which are connected in a network with other records.

Again, the price for this added sophistication is added complexity. Such a system is definitely not for the novice. Perhaps it is most appropriate for professional software developers or for a business that already uses a network structure in its mainframe computer and wants similar power in its microcomputers.

Can a microcomputer database management system ease your record-keeping burdens? Your chances are good if you analyze your needs carefully before you buy and test the capabilities of the packages that interest you. All along the way are trade-offs in price, ease of use, and flexibility. If you find the right mix, you might be coming home to dinner earlier, if not actually living "happily ever after." —Dara Pearlman

MUMPS to Link Micros to Mainframes

If you've been wondering how to link your microcomputer with the larger computer at your office or lab, a computer language that sounds like a disease may be the cure. The Massachusetts General Hospital Utility Multiprogramming System, MUMPS for short, may well become the key to successful micro-mini-mainframe computer networks.

Richard Walters, a professor in the Department of Community Health at the University of California at Davis, is chairman of the MUMPS Users' Group of North America (MUG), headquartered in Washington, D.C. Walters offers several reasons why MUMPS is better than other popular personal computer languages for building networks that link machines of different sizes.

First of all, MUMPS runs in the same form on all kinds of computers. MUMPS on a microcomputer is not a scaled-down version of a language designed for a mainframe, such as FORTRAN or COBOL. It has the same commands and capabilities on all machines, so you can develop a program on a microcomputer, enjoying its fast response time, and then run it on a larger computer shared by many other people.

Another reason for MUMPS' versatility is its built-in file-handling abilities that simplify entering and retrieving information stored in a shared database. The language incorporates a *hierarchical* file structure, similar to the scheme used in the most sophisticated microcomputer database management systems, that stores each piece of information in sorted order on data trees. This means that you rarely need to sort your data, and if you need a specific piece of information, the system can find it directly without a time-consuming search.

Finally, although MUMPS programs run more slowly than programs written in compiled languages such as Pascal or COBOL, it is faster than BASIC in most data-processing tasks, especially when it comes to the handling of nonnumeric data. Yet the language is interactive; that is, a software interpreter translates a MUMPS program line by line as it goes through its paces. If it finds an error, the interpreter will stop the program and issue an error message. This process contributes to speedy program development—Walters estimates that writing a program in MUMPS would take only one quarter the time it would in COBOL.

MUMPS Applications

As an example of a situation particularly suited to a language like

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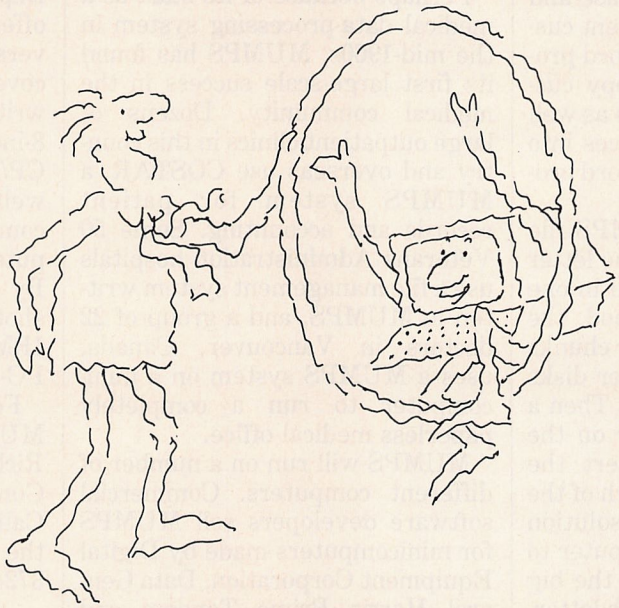
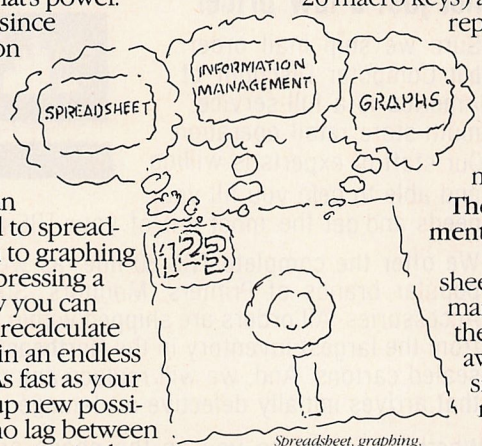


Meet 1-2-3 – the remarkable new software package that puts more raw power at your finger tips than anything yet created for the IBM PC. 1-2-3 actually combines information management, spreadsheet, and graphing in one program that can perform all three functions interchangeably and instantly at the touch of a key. That's power.

To explain: since 1-2-3's information management, spreadsheet and graphing functions reside in memory simultaneously, you can go from retrieval to spreadsheet calculation to graphing instantly, just by pressing a few keys. So now you can experiment and recalculate and look at data in an endless variety of ways. As fast as your mind can think up new possibilities. There's no lag between you and the computer. And that's a new kind of power – power that's greater than the sum of its programs.



Spreadsheet, graphing, information management all-in-one.

The spreadsheet function.

If 1-2-3 were just a spreadsheet, you'd want it because it has the largest workspace on the market (2048 rows by 256 columns). To give you a quick idea of 1-2-3's spreadsheet capabilities: VisiCalc's spreadsheet for the IBM PC offers 15 arithmetic, logical and relational operators, 28 functions and 32 spreadsheet-related commands. 1-2-3 has 15 operators, 41 functions and 66 commands. And if you include data base and graphing commands, it actually has 110!

In addition, 1-2-3 is up to 50 times as fast as established spreadsheets. With all the features you've ever seen on spreadsheets. 1-2-3 also gives you the capability to develop customized applications (with 26 macro keys) and lets you perform repetitive tasks automatically with one keystroke. If 1-2-3 were just a spreadsheet, it would be a very powerful tool. But it's much, much more.

The information management function.

Add to 1-2-3's spreadsheet a selective information management function, and the power curve rises at an awesome rate. Particularly since 1-2-3's information management capability reads files from other programs such as WordStar, VisiCalc and dBase II. So you can accumulate information on a limitless variety of topics and extract all or pieces of it for instant spreadsheet analysis. Unheard of before. Specific 1-2-3 information management features include sorting with primary and secondary keys. Retrieval using up to 32 criteria. 1-2-3 performs statistical functions such as mean, count, standard deviation and variance. It can produce histograms on part or all of the data base. 1-2-3 also allows for the maintenance of multiple data bases and multiple criteria.

The graphing function.

1-2-3 enables you to create graphs of up to six variables using information already on the spreadsheet. And have it on screen in less than two seconds! Once you've made a graph, three keystrokes will display it in a different form. If data on the spreadsheet changes, you can display a revised graph with one keystroke. This instant relationship of one format to another opens up a whole new application area. For the first time graphics can be used as a "what if" thinking tool!

For a full demonstration of 1-2-3's remarkable power, visit your nearby 1-2-3 dealer. For his name and address, call 1-800-343-5414 (in Mass. call 617-492-7171).

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MUMPS, Walters cites the case of a large bank with many credit-card customers. Currently, secretaries consult printouts from a large mainframe computer database and then type letters to delinquent customers on stand-alone word-processing machines. They copy customer names and addresses as well as information about balances into form letters stored in the word processor.

If the bank used a MUMPS file structure for its records, the letter writing could be automated in one of two ways. In one method, the large computer could send chunks of its data to microcomputer disks via a telephone connection. Then a MUMPS program running on the small computer could insert the needed information into each of the form letters. Another solution would be for the microcomputer to send a telephone query to the big database as it produced each letter. This method might slow down the big computer a bit, but it would provide the very latest information for the letter.

Perhaps because of its start as a medical data-processing system in the mid-1960s, MUMPS has found its first large-scale success in the medical community. Dozens of large outpatient clinics in this country and overseas use COSTAR, a MUMPS system for patient records and accounting. Some 50 Veterans Administration hospitals use a file management system written in MUMPS, and a group of 22 doctors in Vancouver, Canada, uses a MUMPS system on a minicomputer to run a completely paperless medical office.

MUMPS will run on a number of different computers. Commercial software developers sell MUMPS for minicomputers made by Digital Equipment Corporation, Data General, Harris, Prime, Tandem, and others. There are also commercial versions for some microcomputers, including the Apple.

Through the Community Health Department at UC Davis, Walters offers a single-user public-domain version of MUMPS for $55, which covers distribution costs. As of this writing, available versions include 8-inch floppy disks for 8080 and Z80 CP/M systems and for CP/M-86, as well as floppy disks for Osborne computers and for Apple computers equipped with Z80 cards. By the time you read this, there should also be a version for the IBM Personal Computer with the PC-DOS operating system.

For more information about MUMPS you can write to Dr. Richard F. Walters, Department of Community Health, University of California, Davis, CA 95616 or to the MUMPS Users' Group, POB 37247, Washington, D C 20013.

—Dara Pearlman

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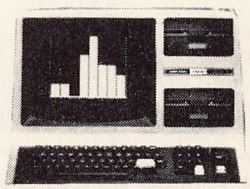

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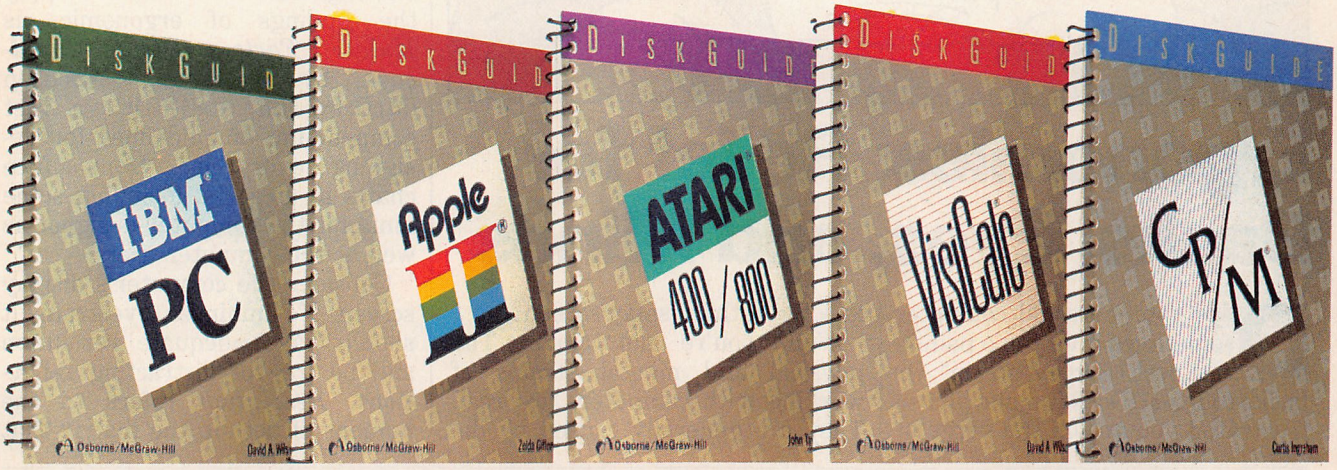

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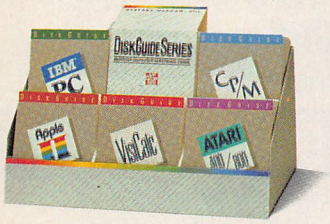

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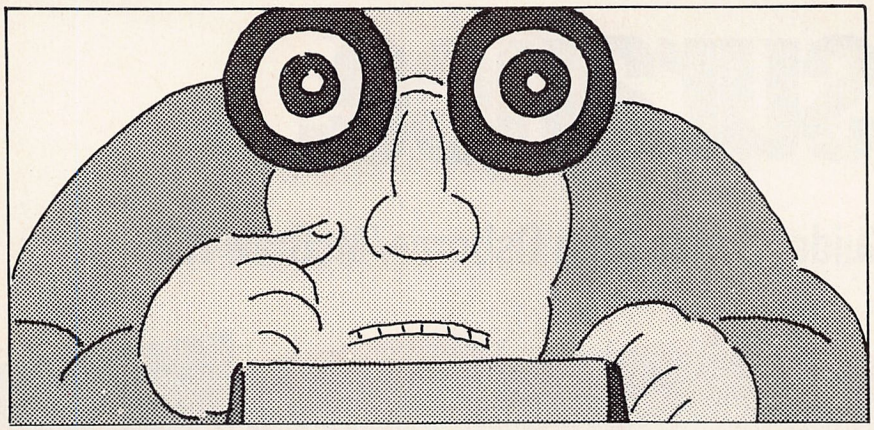

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Ergonomists are people who study topics like how the shape of a hand tool can affect job performance or how many digits a person can reliably remember after a quick glance at a number. The bible for engineers who want to apply the findings of ergonomics is *Human Factors Design Handbook*, by Wesley E. Woodson (McGraw-Hill, 1981). It's a vast compendium of guidelines for designing everything from office chairs to airports, including some hints for the computer designer as well as the computer user.

Consider the computer's display screen. To minimize eyestrain, it should have adequate resolution and be free of distracting reflections. *Resolution* refers to the number of dots in the matrix that

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forms images on the screen. To form a single character, a matrix of 5 by 7 dots is minimally acceptable. That's the usual character matrix on televisions used as display screens. A 7 by 9 matrix, usually found on 80-column monitors, is far better, Woodson notes.

The problem of glare or distracting reflections can be tackled in several ways. The display screen should be positioned so that reflections do not interfere; adjustable video-screen pedestals that allow you to easily change the screen position are a big help. Another approach is to get a screen with a glare-reducing coating or to buy a special screen shield.

How you position your computer on your desk can make the difference between backache and comfort. Beware of stacking your components so that your display screen is at eye level. You should be looking down at the screen, and you should tilt the display screen back so that it matches your normal neck slope, usually about 10 degrees from vertical. This makes the screen perpendicular to your line of sight and lets you avoid craning your neck to get a good viewing angle.

The center of the keyboard should be roughly at elbow level, which is usually 9 inches above your seat. This is where a detachable keyboard shines—it allows you to adjust the angle of your display screen and position your keyboard separately.

Mental Comfort

Some of the new microcomputers on the market take ergonomic guidelines one step further by considering mental comfort as well. Epson's new QX-10 personal computer represents a valiant attempt to make the computer a consumer appliance that the neophyte can unpack, plug in, and use without frustration.

Labels on the keyboard of the QX-10 clearly reveal the functions of the computer. A Help key calls up instructions from a disk, a Copy Disk key copies a disk, and a Calc key makes the system into a four-function calculator.

Apple Computer's Lisa and the Xerox Star are integrated systems that allow the user to switch from task to task by pressing a button on a cursor-control device called a *mouse*. The different capabilities of the computer are graphically represented on the screen as *icons*, and the material you're working on is shown in boxes or *windows*. You use the mouse to move the cursor from window to window.

The trend toward integrated software packages, exemplified by Context Management Systems' Context MBA and Lotus Development Corporation's 1-2-3, also shows the growing concern for ease of use. These packages use similar commands for spreadsheet analysis, database management,

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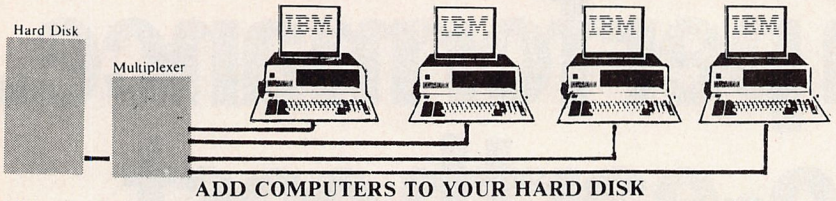

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and creation of graphics, allowing you to work with those elements easily in one document.

One of the pioneers on the frontier of mental ergonomics is Chris Rutkowski, whose consulting firm, Rising Star Enterprises, designed the software and keyboard for the Epson QX-10. Rutkowski says computer users can test for ergonomic design by asking themselves one basic question, "How easy is this system to operate?"

He compares selecting a computer system to buying a suit: "You can pick a suit that's three sizes too small and decide to lose 10 pounds. That's called gaining computer literacy. Or you can buy one that's three sizes too big and get a tailor to take it in. That's a custom installation. Or you can get the right size to start with." And that's likely to be the one with the best ergonomic design.

—Dara Pearlman

Exploring the Memory Jungle

Most of us have a pretty good idea of what horsepower ratings mean when we shop for lawnmowers or what BTUs mean when we shop for heaters, but the acronym jungle of computer memory ratings is often unknown territory, with mysterious Ks, RAMs, ROMs, and EPROMs lurking in the shadows. Don't be intimidated, though—those abbreviations are really quite tame when you take a closer look.

Computer *memory* is simply a measure of information storage capacity—like cubic feet in a warehouse. In general, the more memory a computer has, the more information it can process in one gulp. That translates to faster speed and the ability to handle increasingly complex functions.

A product's description usually measures internal memory in *K bytes*. The K stands for *kilobyte*, meaning 1000 bytes of storage, although technically a kilobyte is 2^{10} or 1024 bytes because computers deal in powers of 2 rather than the powers of 10 we're more accustomed to.

Computers use powers of 2 (the binary system) because the basic component of computer memory is a switch that can only be either on or off. If you represent "off" by a 0 and "on" by a 1, the switch be-

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comes a binary digit or *bit*. String eight of those bits together and you have a *byte*, the number of bits necessary to represent one character in the almost universally accepted ASCII (American National Standard Code for Information Interchange) coding scheme that is a sort of Morse code for computers. To put this in perspective, consider that a typical single-spaced typewritten page holds about 4000 characters; it would take about 4 kilobytes (4K bytes) of memory to store such a page.

Accessing Memory

The brain of the computer, its microprocessor, can reach the computer memory in two ways. The older, slower method is called serial or *sequential access*. In order to find a piece of information, the microprocessor scans the memory one byte at a time until it finds what it needs. It would be like trying to find a specific purchase order in a file cabinet filled with unlabeled file folders. You would have to look through each folder until you found what you were after.

The newer, faster method, used in all modern computers, is called *random access*. Using this technique, the microprocessor can go directly to the information it needs because it knows the right *address*. This is like searching for the same purchase order in a file cabinet with well-labeled folders organized alphabetically. If you know the right heading, you can find the purchase order in very short order.

Now you know how to measure memory and how the microprocessor reaches it, but where is this memory located? The kind of memory described in most product literature is on integrated-circuit chips inside the computer. It's called, logically enough, *internal* memory. The term *external* memory refers to the cassette tapes, floppy disks, Winchester hard disks, or other magnetic material on which the computer can record information for long-term storage.

RAM, ROM, and PROM

Internal memory is the domain of RAM and ROM chips. RAM stands for read/write random-access memory, abbreviated by its last three initials (probably because RWRAM would be too hard to say). It's the fluid part of internal memory. The microprocessor can load programs or data into RAM, erase the information, and start over again: it can read from or write to RAM. This is computer memory at its most flexible. It can contain any kind of information the computer will handle. RAM is *volatile*, which means that when the computer's power goes off, the contents of RAM are lost.

RAM comes in two types. The more common is *dynamic* RAM. It's called dynamic not because it's more powerful than its cousin *static* RAM, but because it changes

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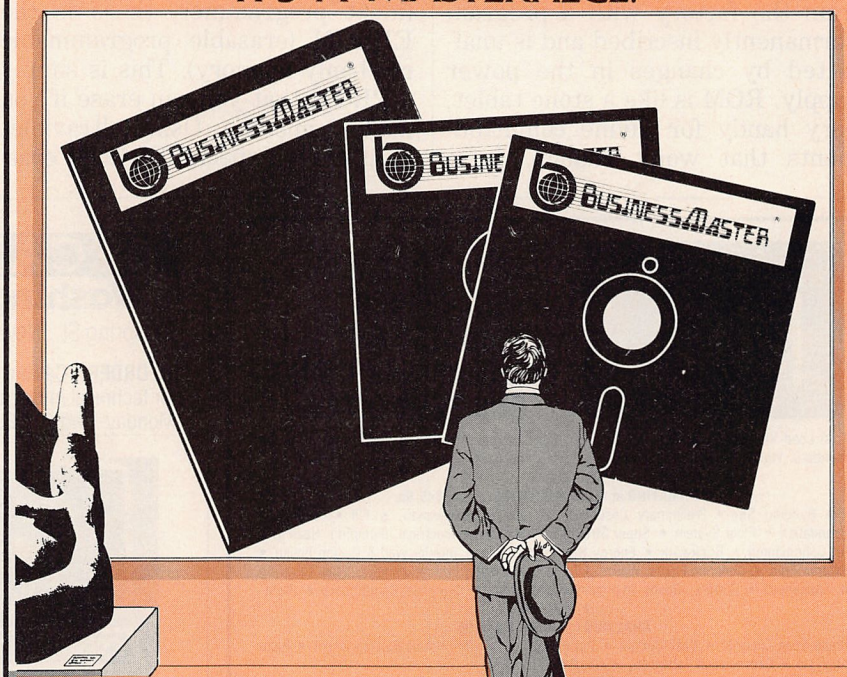

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more often. The electric charges that store information in dynamic RAM can leak away very quickly, so the RAM must be recharged or *refreshed* every 2 microseconds or so. Static RAM doesn't need to be refreshed; it will remember its information until you turn off the power. For this reason, it doesn't need the refreshing circuitry required by dynamic RAM, but it's considerably more expensive.

ROM, the other basic type of internal memory, is read-only random-access memory (with the random access designation left out of the abbreviation). The microprocessor can read information from ROM, but it can't erase or write to it. ROM is *nonvolatile*: it comes from the factory with a program permanently inscribed and is unaffected by changes in the power supply. ROM is like a stone tablet, very handy for divine commandments that won't change. In a microcomputer, ROM often holds programs that start up the computer when the power goes on as well as interpreters for the BASIC language.

The more exotic types of internal memory are most common in home-built and custom-designed computers. PROM, or programmable read-only memory, is a ROM chip that comes blank from the factory. The manufacturer provides the stone tablet and you provide the chisel. With a special device you can load your own custom program into the PROM chip and install it in your computer.

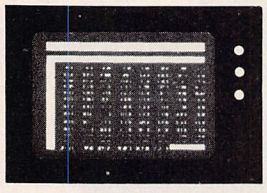
EPROMs

For the less than supremely confident programmer, there is the EPROM (erasable programmable read-only memory). This is simply a PROM that you can erase if you make a mistake. Using ultraviolet light from a special EPROM erasing device you can wipe out your old program and start again.

Finally, there's EEPROM, or electrically erasable programmable read-only memory. It's basically an EPROM with an additional refinement: its erasing device uses electrical signals rather than ultraviolet light, and it can choose which individual bits to erase. For large computer systems, this kind of chip also has the advantage of easier maintenance. If the manufacturer needs to change an EEPROM program, a technician can do it over a telephone communications link without visiting the installation.

As you can see, the strange words in the alphabet jungle of computer memory are meaningful after all. Now that you know a bit about them, you're ready to use the measures and designations of microcomputer memory when you shop for your system.

—Dara Pearlman



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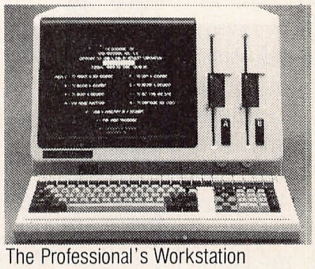
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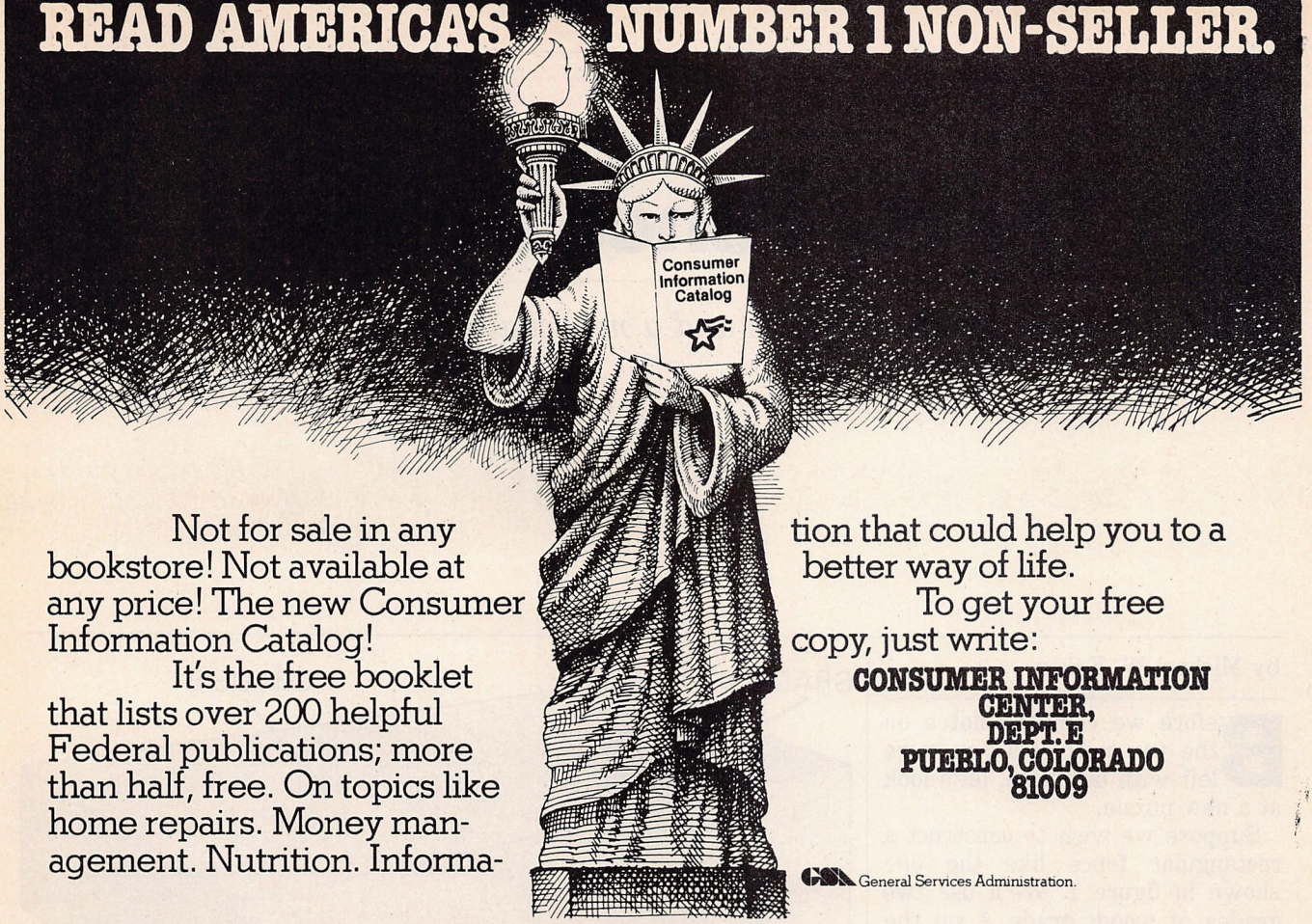

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The Thrifty Fence Builder

Solutions to last month's puzzles and a new challenge

by Michael W. Ecker

Before we compare notes on the two problems you were left with last time, let's look at a new puzzle.

Suppose we wish to construct a rectangular fence like the one shown in figure 1. We'll use two grades of wood: grade A on the north and south sides of the lot and grade B on the east and west sides. (Why? For aesthetic and other reasons, such as the need to make this a harder problem.)

Unfortunately, we have only $400 to spend on the fencing material. Grade A wood costs $5 per linear foot while grade B sells at $4 per linear foot. What are the dimensions of the largest possible rectangular lot we can enclose without going over our budget? Specifically, we wish to maximize the area of the rectangle that can be fenced for $400. It doesn't matter which sides end up being longer or which grade of fencing we use the most of—we're interested only in the area enclosed by the fence.

Can you come up with a BASIC program to solve this puzzle? Next month, we'll present one answer.

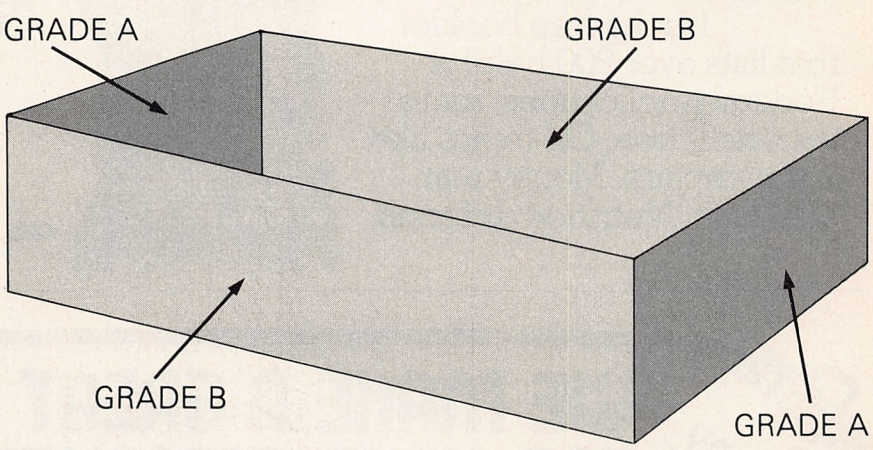

Figure 1: Grade A fence costs $5 per foot; grade B costs $4 per foot. What's the largest area you can enclose for $400?

Last Month's Problems

Now for the "base 2" card trick—remember that the program we presented asks you to choose a number from 1 to 63 and then look for your number in each of a series of six screens provided by the computer. After you indicate which screens contain your chosen number, the computer magically comes up with your exact number.

How does it work? The name "base 2" suggests the explanation. Every positive whole number can be represented in one and only one way as a sum of certain numbers in the series 1, 2, 4, 8, 16, 32, etc. For the sake of this article only, we'll refer to the unique sum as a binary (base 2) expansion. To ensure the uniqueness of each sum, we have to specify that each of the powers of two may be used only once (or not at all) in the expansion.

Take the number 25 as an example. According to our rules, here's the one (and only) expansion that produces it: 16 + 8 + 1. Of course, we could have used 8 + 8 + 4 + 4 + 1, but that's not allowed because no number may be repeated in the expansion.

How does this relate to the puzzle? Figure 2 shows the six screenfuls of numbers that the computer asks you to examine. Notice that the first screen contains only those numbers that require 1s in their expansions. For example, 25 (16 + 8 + 1) is there, but 24 (16 + 8) is not. Accordingly, when you tell the computer whether your chosen number is on the screen, you are really telling it whether your number has a 1 in its binary expansion. If your answer is yes, the computer adds 1 to the guess it is beginning to develop.

Contributing editor Michael W. Ecker is an assistant professor of mathematics at Pennsylvania State University (Worthington).

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A similar process is invoked with the second screenful of numbers. Can you tell what these have in common? Take a minute to figure it out before reading on.

As you probably determined, each of the numbers in the second group has a 2 in its binary expansion. In telling the computer whether your number appears in this group, you are really telling it whether your number contains a 2 in its binary expansion. If your answer is yes, the computer adds 2 to its guess. For the number 25, your answer would be no.

The next four screens check for 4, 8, 16, and 32 in your number's binary expansion. Each of these numbers is added to the computer's guess only if you tell the computer that your secret number is included in the respective screen. For the number 25, your answers would be yes (8), yes (16), and no (32).

By the time you've finished, the computer knows exactly what your number must be—its guess is now a certainty (assuming you've answered the yes/no questions truthfully).

By the way, even though the program doesn't say so, you can pick 0 as your starting number. Because none of the six screens contains 0, the computer will not have any yes answers and therefore nothing to add up as its guess. It will be left with a guess of 0.

Care for a slightly more mathematical explanation? Every positive integer (whole number) may be represented uniquely in the form $(a \times 1) + (b \times 2) + (c \times 4) + (d \times 8)\ldots$. The coefficients a, b, c, d, and so on are equal to 0 or 1.

This compares to the more familiar base 10 expansion in which every number can be written in the form $(a \times 1) + (b \times 10) + (c \times 100) + (d \times 1000)\ldots$. In this case, the coefficients are equal to one of the numbers from 0 to 9.

Figure 2: How does the computer guess your number by asking these six questions?

```
 1  3  5  7
 9 11 13 15
17 19 21 23
25 27 29 31
33 35 37 39
41 43 45 47
49 51 53 55
57 59 61 63

DOES YOUR NUMBER APPEAR ON SCREEN (Y OR N)?
```

```
 8  9 10 11
12 13 14 15
24 25 26 27
28 29 30 31
40 41 42 42
44 45 46 47
56 57 58 59
60 61 62 63

DOES YOUR NUMBER APPEAR ON SCREEN (Y OR N)?
```

```
 2  3  6  7
10 11 14 15
18 19 22 23
26 27 30 31
34 35 38 39
42 43 46 47
50 51 54 55
58 59 62 63

DOES YOUR NUMBER APPEAR ON SCREEN (Y OR N)?
```

```
16 17 18 19
20 21 22 23
24 25 26 27
28 29 30 31
48 49 50 51
52 53 54 55
56 57 58 59
60 61 62 63

DOES YOUR NUMBER APPEAR ON SCREEN (Y OR N)?
```

```
 4  5  6  7
12 13 14 15
20 21 22 23
28 29 30 31
36 37 38 39
44 45 46 47
52 53 54 55
60 61 62 63

DOES YOUR NUMBER APPEAR ON SCREEN (Y OR N)?
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```
32 33 34 35
36 37 38 39
40 41 42 43
44 45 46 47
48 49 50 51
52 53 54 55
56 57 58 59
60 61 62 63

DOES YOUR NUMBER APPEAR ON SCREEN (Y OR N)?
```

Listing 1: A BASIC program that solves the eccentric jailer problem.

```
10 PRINT TAB(18) "THE ECCENTRIC JAILER"
20 PRINT TAB(15) "(C) 1983 POPULAR COMPUTING"
30 PRINT
40 PRINT "CELL #1 WILL BE OPEN"
50 FOR K=2 TO 100: REM TRY ALL CELL NO'S FROM 2 TO 100
60 S=0
70 FOR J=1 TO K: REM TRY ALL POSSIBLE DIVISORS OF J
80 IF K/J=INT(K/J) THEN S=S+1: REM COUNT THEM IN S
90 NEXT J
100 IF S/2=INT(S/2) THEN 120: REM IS S ODD OR EVEN?
110 PRINT "CELL #" K "WILL BE OPEN"
120 NEXT K
```

In the first case, we use powers of 2, in the second, powers of 10. For any case, the coefficients are equal to one of the numbers from 0 to 1 less than the chosen base.

Now, just as we do not write base 10 numbers in expanded form, for example, $134 = 4 + (3 \times 10) + (1 \times 100)$, we do not write base 2 or binary numbers in expanded form. Instead, we write 25 in base 2 as 11001. The 1 on the extreme left indicates a 16, the next 1 indicates an 8, and the 1 on the right indicates a 1. As an exercise, you might try writing 47 in base 2 form. Figure out the expansion, then pack it into a string of 1s and 0s as we did above.

So, the base 2 trick has led us to an explanation of binary numbers!

The Jailer Problem

To recap from last month: an eccentric jailer makes a complicated amnesty offer to his 100 inmates. Every second, he reverses the status of certain cell doors from open to closed or vice versa. After one second, he switches cells whose numbers are multiples of 1 (all of them are opened). After two seconds, cells whose numbers are multiples of 2 (even-numbered cells) are switched. After three seconds, he switches cells whose numbers are multiples of 3, and so on. He repeats this process for 100 seconds. If a cell door is open after the last switch, the con in that cell goes free.

Now, as we asked last month, which inmates will benefit from this amnesty offer?

The key to the solution of the problem is the recognition that a cell is switched once for each number that divides evenly into the cell number. For example, cell number 6 will be switched at seconds 1 (open), 2 (closed), 3 (open), and 6 (closed)—these are the divisors of 6. If a cell number has an even number of divisors, then that cell will be closed when all the switching is over. Only cells whose numbers have an odd number of divisors will be open after all is said and done.

The program in listing 1 finds and lists all the cells that will be open after the 100-second switching process. Why not type it in and try it out before continuing?

Did you notice the rather striking pattern to the cells that are open? Next time I'll offer an elementary mathematical explanation of why we get such an elegant result.

If you have questions or ideas for recreational games, send them directly to me (enclose a stamped, self-addressed envelope if you wish a reply):

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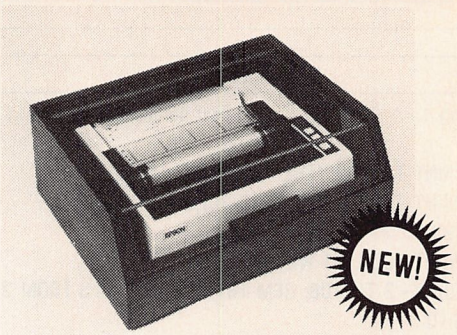

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Books for Beginners

BASIC training for computer novices

The Beginner's Guide to Computers

Robin Bradbeer, Peter De Bono, Peter Laurie
Addison-Wesley Publishing Company
Reading, MA, 1982
208 pages, softcover $9.95
hardcover $19.95

It's BASIC: The ABC's of Computer Programming

Shelley Lipson
Holt, Rinehart, and Winston
New York, 1982
46 pages, hardcover $8.70
Reviewed by Jonathan Amsterdam

Before you read any further, take this little test. When you hear the word "byte," do you think of food? Does "hardware" bring to mind wing nuts and washers? Do you believe that a RAM is a Los Angeles football player? If you answered yes to any of these questions, congratulations—you're a computer novice. You know nothing about computers, but you'd like to learn. Well, have we got two books for you.

The Beginner's Guide to Computers is a general introduction to the world of computing. It was written by three British educators and is based on the British TV show *The Computer Programme*. The book contains pretty much what you'd expect an introductory book to offer. It begins with a description of how computers are used today, mentioning topics like air traffic control and weather prediction. A brief history of computers follows, and then the authors discuss how the computer operates. Other sections describe the various components of any computer system (such as memory and the central processor), what assembly language is and how it works, and what computers will do for us in the future. A chapter on microcomputers tells what they're used for, how they work, and how to buy one. The limitations of computers are also considered.

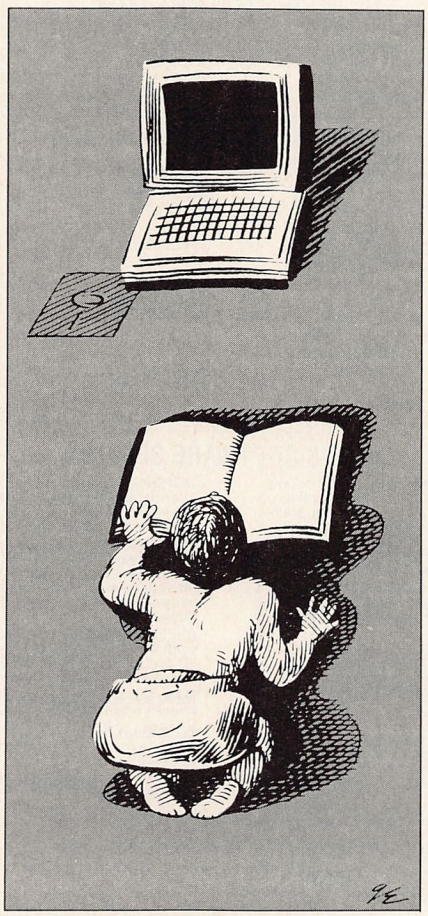

Illustration by Gil Eisner

All of this is standard fare, but the authors present it well and manage to keep it all interesting and understandable. The writing is very clear and friendly, and pictures and diagrams abound.

If this were all the book contained, it would be a perfectly good introduction to computers. But there's more. One chapter is devoted entirely to a discussion of how to solve problems. You might think this is out of place in a book about computers, but it isn't; to understand computers, you have to understand how problems are put in a form that the computer can digest.

The authors make the very good point that people, not computers, solve problems. All a computer can do is carry out a solution that a person has programmed into it. By solution I don't mean the answer to a problem, but rather the method used to arrive at the answer. The power of the computer lies not in its ability to develop new methods—it has no such ability—but in the speed and accuracy with which it carries out its instructions.

It takes some time to get used to thinking about problems in a way that will allow you to program a

Jonathan Amsterdam works in the Artificial Intelligence Lab at MIT.

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computer to deal with them. Making you familiar with this sort of thinking is the authors' goal, and they do a very good job of it. They present several concrete, real-world problems, including making up the schedule for a football team (by which they mean soccer, of course, but the sport itself never really enters into it, just the scheduling) and finding the best route from New York to Washington (doubtless changed for the American edition from Manchester and London). The authors go through the problems one by one, analyzing them and pointing out different possibilities for solutions. For some of the problems, we're given flowcharts of possible solutions—graphic representations of how to solve the problem.

One chapter closes the gap between having a description in English of a problem's solution and having the computer carry out that solution. Closing that gap involves programming the computer—translating a description of a problem-solving method from some natural language like English into a programming language that the computer can digest. The world's most popular programming language is called BASIC, and that's what *The Beginner's Guide to Computers* teaches you. The introduction is more than a casual one. In 30 pages, the authors go from the simplest aspects of the language to some fairly advanced concepts. The chapter culminates in a computer program for solving the New York-to-Washington problem mentioned earlier.

All in all, *The Beginner's Guide to Computers* is an exciting book that covers a lot of ground. While it's a great introduction to computers, I have just a few warnings. First, this is not the book to get if you want specific information on which microcomputer to buy. The section on microcomputers names no names, and although buyers' guidelines are given, they're very vague.

Second, the chapter on programming mentioned above is faster-paced than the other chapters, despite the more difficult material. Quite a lot of information is covered in 30 pages. On the bright side, this section on BASIC would make a good primer for someone at a slightly more advanced level—for example, someone who's read the next book.

It's BASIC: The ABC's of Computer Programming, which also assumes the reader knows nothing about computers, is a much less ambitious book than *The Beginner's Guide to Computers*. The book is only 46 pages long, a quick read even for a child, and children are definitely the target. Author Shelley Lipson taught pro-

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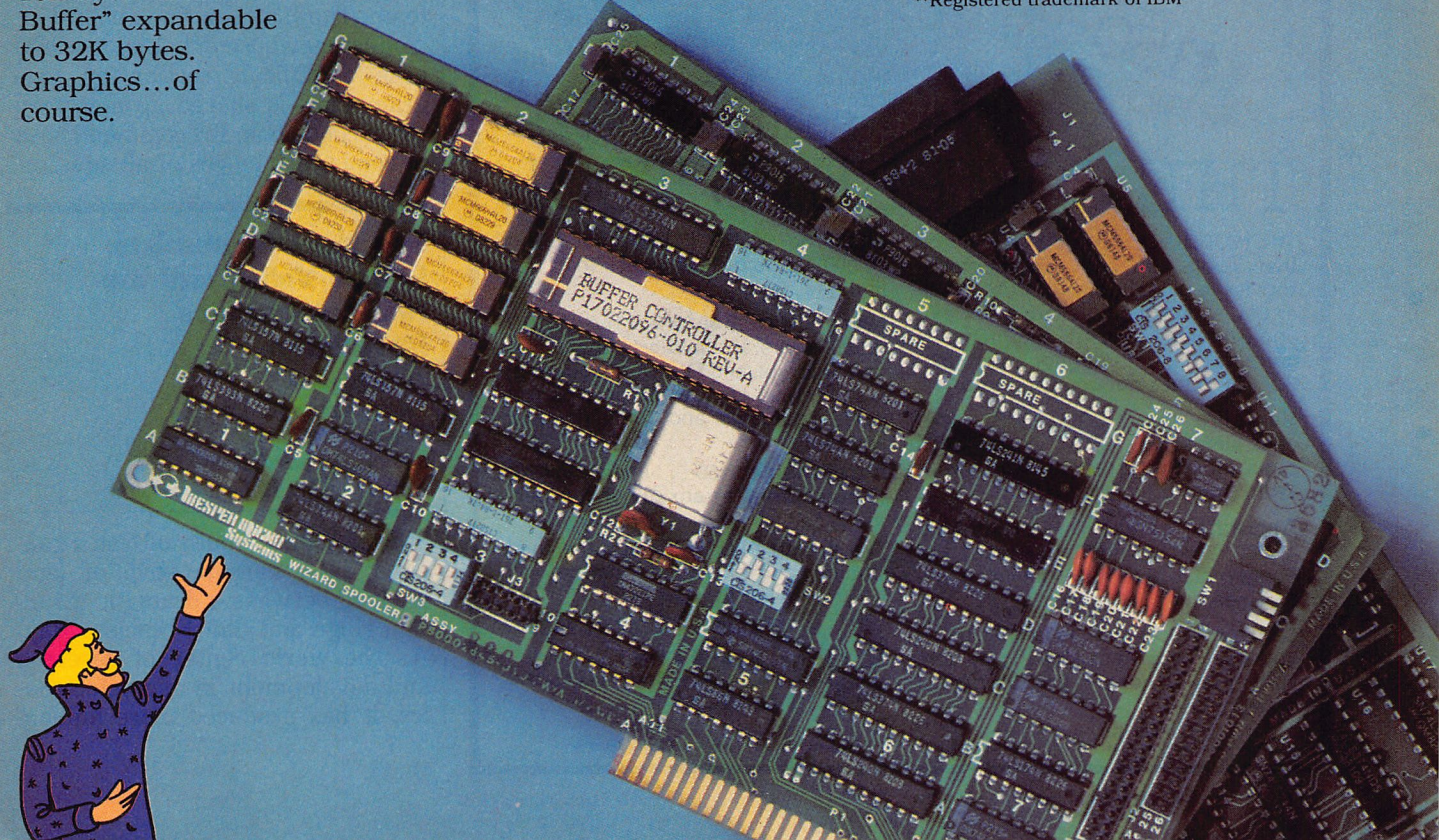
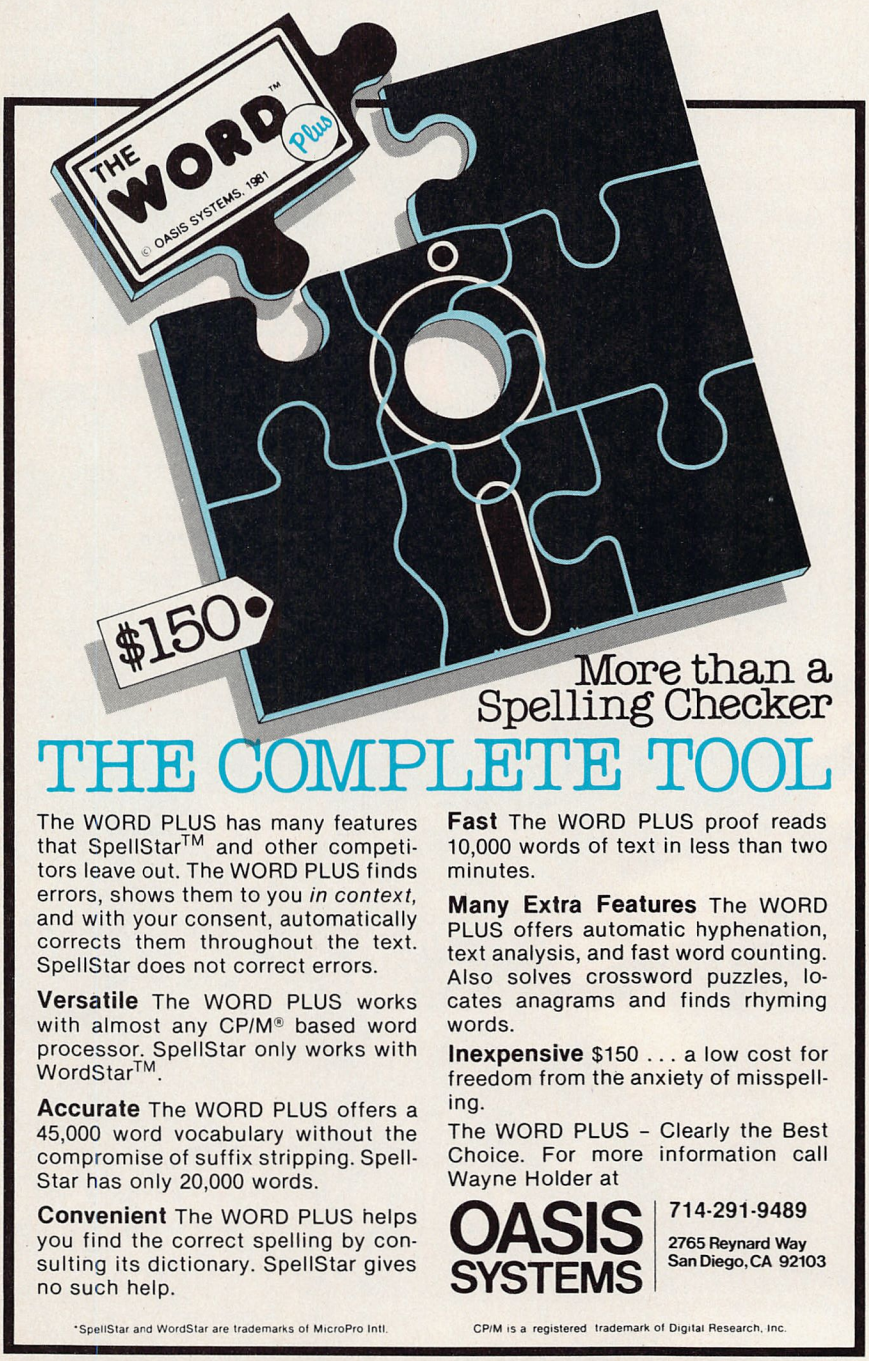


gramming in elementary schools and became convinced that even very young children can learn how to program. So, in *It's BASIC*, Lipson offers an explanation of the BASIC programming language, accompanied by line drawings of cute children of all races and colors saying things like, "Hey, if I use GOTO with the INPUT instruction, I can get the computer to do my multiplication homework!" Clever kids, but lazy.

After that whirlwind chapter on BASIC in *The Beginner's Guide to Computers*, *It's BASIC* is pleasantly slow. The author begins with brief discussions of what it means to program and what the distinction between input, output, and processing is. She then starts teaching BASIC by demonstrating the PRINT statement, printing, among other things, your name (if it happens to be Debbie), a knock-knock joke, and the solutions to problems like 2 + 6 and 67 - 60. The rest of the book shows you how to get the computer to accept inputs, make decisions, repeat instructions, and even do your multiplication homework. Lipson covers only the basics (so to speak); she discusses none of the more advanced and powerful features of BASIC.

It's BASIC is a painless and fun introduction to programming. Even though it's written for children, adults will still be able to get something out of it. In just half an hour, you'll understand the rudiments of computer programming. But *It's BASIC* goes no further. If anything, the book is *too* simple. Its most complicated program tells you if you're old enough to vote by asking you your age and seeing if the number you enter is less than 18. If that were the best a computer could do, I'd stick to my pocket calculator. But of course a computer can do much more—you'll just have to go elsewhere to learn about it.

The Beginner's Guide to Computers and *It's BASIC* make a good team. The first is a fine general introduction whose only major weakness—a difficult section on programming—is shored up nicely by the second book. I recommend both to computer novices of all ages.



The New Alchemists: Silicon Valley and the Microelectronics Revolution

Dirk Hanson
Little, Brown & Co.
Boston, 1982
332 pages, hardcover $15.95
Reviewed by Robert Ferrigno

Silicon Valley, south of San Francisco, is a narrow strip of land wedged between a dramatic mountain ridge and San Francisco Bay. As the world center of research and development in microelectronics, it has produced more million-

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aires during the past 15 years than any other location on earth. In *The New Alchemists*, Dirk Hanson offers a historical overview of the development of that technology and the people who made it happen.

The original alchemists were fourteenth-century chemists who decided that the really big money was in research and development and set about finding a method for turning lead into gold. The lead-gold transmutation never really panned out, but in the process the alchemists discovered many of the elements now listed in the periodic table. While they weren't scientists in the modern sense of the word, the alchemists worked on the outer fringes of the knowledge of their times and struggled to master forces of great importance.

Hanson shows that the new alchemists of Silicon Valley have inherited the tradition of maverick research stretching from the Middle Ages to the twentieth century. Following in the footsteps of Thomas Edison and other electronics pioneers, they have restored the individual scientist/inventor to primacy. In an age of giant corporations, Hanson claims that "the major wellspring of technological innovation is the small, rapidly mutating, new start-up company." It is in these small, efficient companies that the new alchemists find the freedom to be creative and the state-of-the-art facilities needed to bring their research to fruition.

The author keeps things lively by focusing on the innovators who made Silicon Valley what it is today. He tells us about Andrew Grove, an immigrant, whose observations of the McDonald's checkout line shaped his perspective on assembly-line techniques. When he became production chief at Intel, he used those techniques to dramatically reduce the production cost of semiconductor chips, a breakthrough that eventually led to the inclusion of microprocessors in a wide variety of consumer products.

Another innovator profiled in *The New Alchemists* is Robert Noyce, who developed the integrated-circuit concept while head of research and development at Fairchild Semiconductor. Noyce left Fairchild to found Intel and make it one of the giants in the field. Jumping from one company to another, Noyce has been responsible for breakthroughs wherever he has worked.

Hanson is especially critical of military R & D in silicon technology. In particular, he cites Noyce's opinion that much of the effort in military research has been misdirected and wasteful. Also, Hanson analyzes the weakness, as he sees it, of the Wimex communications system, a vital component of the U.S. military's global command structure. Wimex relies on an outdated network of computers, according to Hanson, and has been found to be "operationally vulnerable" by a panel of independent computer experts. While asserting that the Russian system is at least as outmoded as ours, Hanson warns that our military computers need to be upgraded. Unfortunately, he doesn't tell us much about the current status of the Defense Department's R & D in microelectronics. A subject of such importance merits more attention than Hanson has provided.

The New Alchemists delivers so much information about the history of silicon technology that I can't help wanting even more. For example, a glossary would have helped the general reader understand some of the more technical information. Diagrams, such as a 20-year chart of significant breakthroughs in the field, would have been extremely helpful, as well. The book works without them, but additional explanations would have made it much richer.

All in all, *The New Alchemists* is well worth reading. Dirk Hanson has provided a useful historical overview of a critical aspect of our society: the people and organizations that created the silicon chip and paved the way for the age of information.

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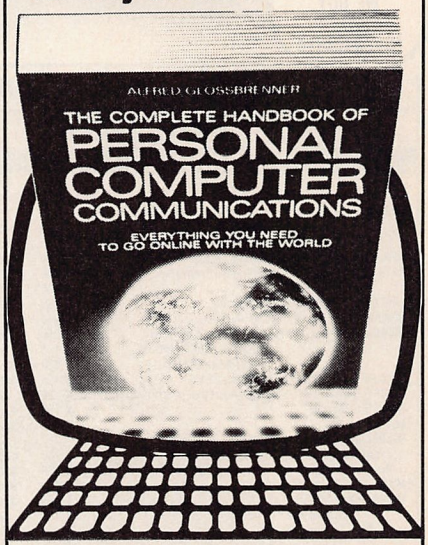

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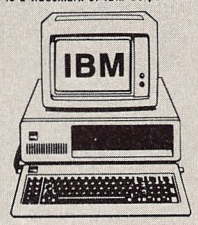

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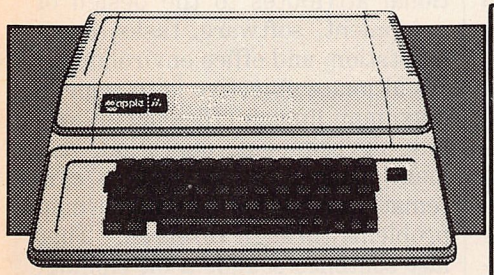

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Human Factors in Office Automation

Wilbert O. Galitz
Life Office Management Association
Atlanta, 1980
237 pages, softcover $9.95
Reviewed by William Keough

According to Dr. Tom Gleason, a Soviet historian at Brown University, the Russians are having real problems getting people to accept computerization in their offices. "Some of the workers," says Gleason, "have gone so far as to pour vodka into their display units." The prospect of drunken video monitors ought to be enough to give the hardiest and most sanguine systems designer a moment's pause.

We know computers are wonderful, and we also know (or will learn to our chagrin) that human beings can do almost anything, deliberately or accidentally, to mess them up. As designers are so fond of saying, there is no such thing as computer error, just human error. Well, so be it, but that still leaves us with a problem because computers are operated by humans.

Human Factors in Office Automation, by Wilbert Galitz, is an attempt to identify all the human factors that might affect optimum performance in the offices of the future. Galitz claims that ignorance of human factors has caused widespread disaster in many an office and that response to these problems has largely been a hit-or-miss affair. So Galitz has surveyed the field and made a valiant attempt to bring all the relevant information together under one cover.

Human Factors in Office Automation encourages the design of "friendly" systems that allow human beings to work efficiently without going mad. As Galitz puts it, "Human-factors analysis involves systematically applying knowledge of people's sensory, physical, intellectual, and motivational attributes to the design of equipment, software, tasks, documentation, and office environment. Its ultimate objective is to achieve maximum human efficiency in system development, operation, and maintenance. At its core is systematic analysis of human/machine problems through research." That last sentence sounds a bit chilling, as if to suggest running humans through computerized offices like rats through mazes. But, considering the alternative of dumping sophisticated computer machinery on relatively unsophisticated office workers, human-factors research seems both necessary and humane.

Unfortunately, Galitz is no Tracy Kidder. The book is laced with unnecessary jargon and duplication, and, more important, it lacks a proper conclusion. A good crisp summary or overview would have helped. And it somehow seems inevitable, in a seminal work of this nature on a complex subject, that some real howlers crop up. Galitz tells us, for instance, that "the objective of human performance is to perform skillfully" and that "common destinations (toilets, elevators, photocopy machines, etc.) should be close together and accessible by direct routes." In other words, don't hire the Marx brothers and don't put the john in the basement.

But for office managers who have to set up a new computerized office or reform an old one and for manufacturers and designers of computer equipment, *Human Factors in Office Automation* should prove to be a valuable resource. Cogent arguments are put forward for the superiority of orange-phosphor monitors and uncluttered display screens, for three-walled offices and proper lighting, and for allowing workers to develop their own best rhythms. Most of Galitz's suggestions are sensible and economi-

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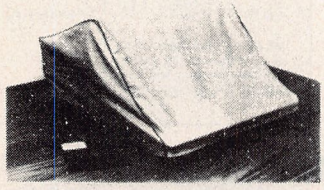

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cal. Not surprisingly, office workers polled about their own priorities ranked noise levels, heat, lighting, and privacy as their primary considerations in the office environment. That paints a human picture that tells us office workers want to be able to hear themselves think in a place where their hands are not cold, where they can see without squinting, and where they can talk to their chums occasionally without managers looking over their shoulders. . . . Now if we can keep the vodka out of the office. . . .

Celestial BASIC

Eric Burgess
Sybex Inc.
Berkeley, CA, 1982
300 pages, softcover $13.95
Reviewed by Peter Owens

On October 15, 1582, the good Pope Gregory XIII ordered a 10-day holiday. This was no ordinary holiday, though: instead of giving people 10 days of free time, the pope simply erased these days from time altogether. As you can imagine, this papal time warp set off great howls of protest from the citizenry, who believed that the Holy Father had actually shortened their lives by 10 days.

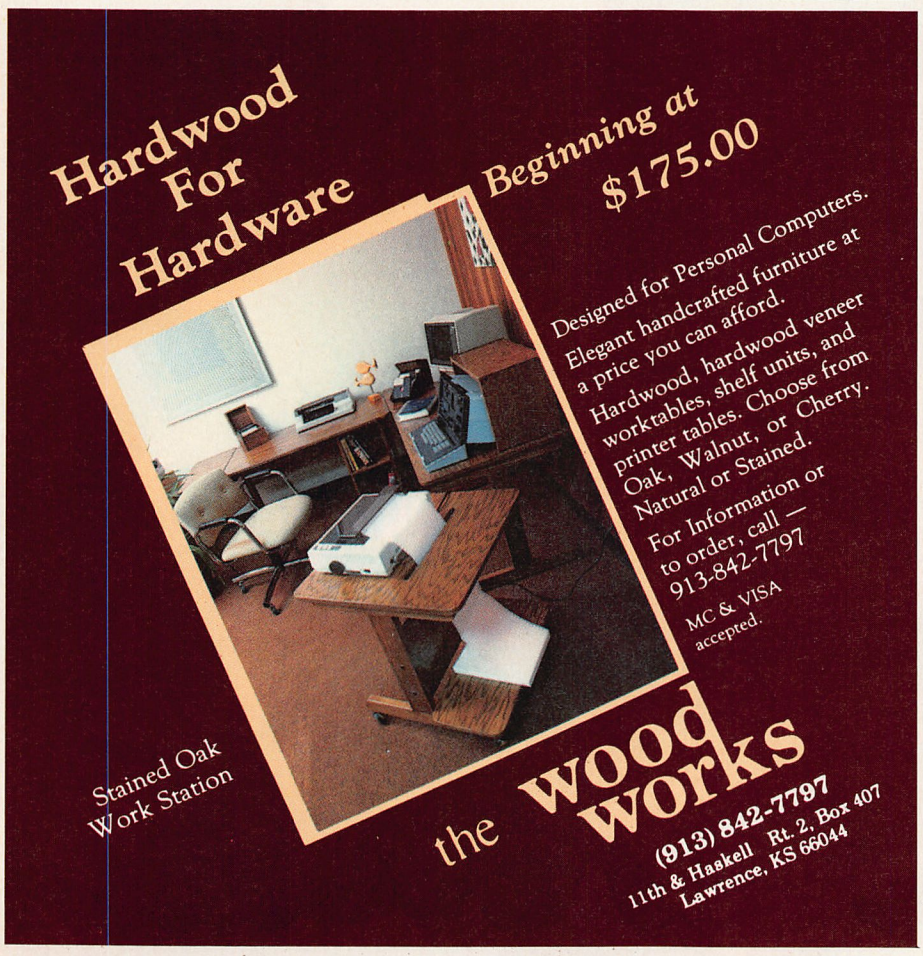
In fact, the pope was correcting the accumulated creep of an 11-minute-per-year error in the Julian calendar that Julius Caesar 1500 years earlier named after himself and established as the calendar of record. While the pope was at it, he changed New Year's Day from March 25 to January 1, and in the fashion of the day he named the new calendar after himself. Today, most of the world still uses the adjusted Gregorian calendar.

The 11-minute error was the result of a cosmic miscue, a minuscule one to be sure, but in the vast reaches of time and space, minor miscalculations can gobble up numbers and raise holy havoc with the best-laid plans. If it weren't for the timely foresight of Pope Gregory, we'd be celebrating Easter sometime in July or August by now.

The measurement of time is just one of the chores of astronomy that author Eric Burgess has computerized in *Celestial BASIC*, a book that offers "amateur and armchair" astronomers a new window on the universe. You can look into that window, the video-display monitor on your home computer, and see constellations, planets, stars, flashing meteors, and other astronomical wonders. If you want to know what day Easter *really* falls on (up until the year 2099, anyway), Burgess has a program for you. If you want to know when the next lunar eclipse will be, *Celestial BASIC* gives you a program. You can discover the phases of the moon and figure out the rising and setting times for planets. If you want to know when the next meteor shower will be, you can find out from Burgess's shooting-star program.

Why would an ordinary backyard stargazer want or need this sort of information? Perhaps we should rephrase the question: does anything in this book stimulate a stargazing home computer owner to explore the universe with the degree of earnestness required of an amateur astronomer? Speaking as an ordinary stargazer, I would have to admit that *Celestial BASIC* has me poised to buy a telescope so that I can explore all these spacy notions further and maybe find some order in all that nocturnal chaos up there.

Charting the heavens is an ideal computer application. The formulas and numbers in astronomical calculations are enough to frighten off all but the most avid number crunchers, but to the computer they're just so many bits of welcome nutrition. This book lets the reader use a computer to escape numbers in their most intimidating



forms and to skip past the tedious mazes of traditional astronomical charts and diagrams. Although *Celestial BASIC* may not transform astronomy into a new national pastime, it does offer unprecedented accessibility to what has always been an esoteric and dizzyingly complex hobby.

Not to be underestimated, moreover, is a second virtue of the book: it offers a fascinating application that can open new vistas in home computing. Unlike many home computer applications, those in *Celestial BASIC* do not make the computer perform solely to display its own dazzle. Here the computer does real work that can lead you to a better understanding of the universe. The book also provides its readers with a means of learning more about programming as they carefully enter program listings into their computers. In the end, the real purpose of the book is to help people look at the night sky and make sense of it, and to that end the author enlists the computer as a useful and dogged worker.

The book offers 23 programs, each accompanied by a short, highly readable essay explaining how the program works and what mysteries it was designed to uncover. This text is sprinkled with interesting tidbits about astronomy and its history. Predictably, some programs are much shorter and easier than others; the most powerful and useful turn out to be the longest and most demanding. Designed on an Apple II, the programs, says Burgess, can be easily converted to run on the IBM Personal Computer, TRS-80, Atari, Commodore PET, and Exidy Sorcerer (owners of the latter will find three already-converted programs at the end of the book). Burgess suggests that 48K bytes of RAM (random-access memory) "can readily hold several of the programs," but each of the longer programs would exceed the 16K-byte memories of smaller machines and require judicious trimming.

The simplest of the programs has 53 lines and calculates on what day Easter falls between the years 1900 and 2099. When you enter the year, you're quickly offered a display of the corresponding month and day of Easter. I entered the program into a 16K-byte TI-99/4A and immediately discovered that Burgess has compressed numerous IF/THEN statements and other calculations on single program lines, thus forcing me to set up closed GOTO subroutines that jump in and out of the main program. For computers that don't accept multiple commands on single lines, conversion is a bit more tedious.

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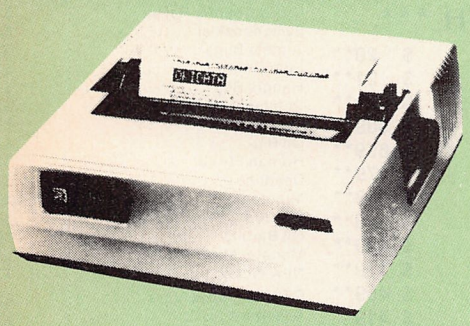

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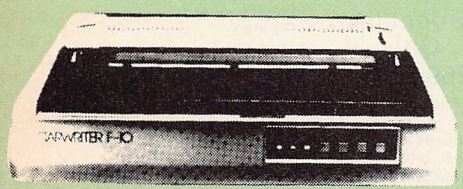

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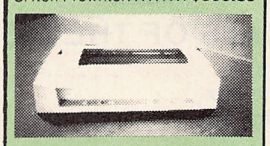

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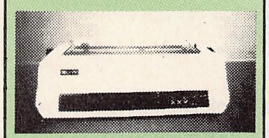

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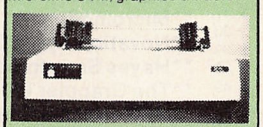

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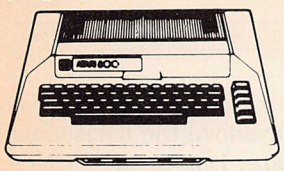

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lunar eclipses using 88 program lines. A 128-line program provides the dates of the phases of the moon and interpolates a complete lunar cycle around any given date. This program is useful not only for moon gazing, but also for figuring out whether the moon will be so bright as to inhibit other astronomical observations. As Burgess points out, "You might want to know whether the moon is going to be bright before you decide to take a telescope to the top of a mountain to photograph some faint objects in the sky."

Some of *Celestial BASIC*'s most exciting programs actually display constellations, stars, and planets on the computer's video screen. "Today," writes Burgess, "the personal computer can bring the planetarium into your living room. The monitor becomes the domed ceiling, and on it you can see the sky for any date and time at any location on our planet." One of these programs is a tutorial aimed at teaching casual stargazers how to recognize 42 major constellations. Unlike an astronomy text or guidebook, the video displays have no lines connecting the stars, forcing viewers to delineate constellations mentally, just as they must when looking at the real sky.

In this video-display planetarium, stars are represented by asterisks, periods, or Xs that indicate relative brightness. The tutorial program runs about 1000 lines, but it can be trimmed to fit smaller computers simply by eliminating some of the constellations from the data list. Variations in display formats and dimensions of the video screen can affect the appearance of some constellations, but you can proportionally adjust the images to the width of your screen if it is too small to show all of Burgess's stars. I kept losing the highest star in the constellation Centaurus, but I was able to note its location as it scrolled up the screen before disappearing.

Burgess also gives us a program that displays constellations as they would appear above the horizon on any given date. Due to the earth's subtly wobbly rotation on its axis, stars appear in slightly different positions throughout the year. The planets change locations constantly, making it easy to become disoriented. But if you want to locate a planet on a given evening, the computer will furnish a display of the planet's position relative to one of the constellations.

Probably the jazziest program of all provides the dates of meteor showers and displays their locations relative to major constellations. In June, for example, we discover two showers, one featuring eight "bluish meteors" per hour. In an alternate program for the Exidy Sorcerer, the meteors actually zing across the screen.

Many of the programs offered in the book provide this sort of locational information, which otherwise would have to be gleaned from numerous mystifying charts and complicated tables. In keeping with solid data-processing principles, the data you enter into the computer can be served up time and again in new formats by entering simple commands that trigger new calculations and reports.

Celestial BASIC also includes several calendars, an astronomical conversion table (for light-years, meters, telescope power requirements, etc.), solar system data (specifics on planet size, gravitational power, distance from sun, etc.), and even a program that indicates film type and camera settings for photographing the planets.

The only major drawback to all this celestial fun is that all of these programs must be typed in with great care and precision. You'll need the patience of Job for programs of 1000 lines, and by the time you get finished you'll probably be thinking the same way Pope Gregory's howling followers did four centuries ago. You'll probably feel that 10 days have been erased from your life. But that may be just a small price to pay for order in the universe. □

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The Electronic Loom

Weave your own designs with this BASIC program

by George Stewart

In keeping with the summer season, let's get away from math drills, magic squares, and anything else that might remind us of the usual schoolwork. How about weaving? It doesn't matter if you've never tried it; you don't even need a loom. All you need is a computer that runs a version of Microsoft BASIC. If you have a printer, you'll be able to save your creations on paper.

The Electronic Loom is a program that turns your computer screen into a grid on which you create designs. You specify the length and width of the design (it must fit on your display) and create patterns by combining any characters your computer can display and print. Common punctuation and other symbols work well for giving a rough approximation of real loom work.

If you're interested in weaving, you can use the program as a planning aid to help visualize how certain patterns will look without actually weaving them on a loom. You can associate some characters with specific weaving techniques and associate other characters with various thread colors. For example, as we see in the figure at right, a block of hyphens might represent a plain weave, a block of alternating hyphens and equal signs might represent a twill weave with its characteristic diagonal pattern, and a repeating pattern might represent a satin weave.

If you don't like weaving—even weaving on a computer screen—you can use the program to create any kind of designs—flags, Snoopy cartoons, and so forth. If that suits you better, just forget about threads, patterns, and loom boundaries.

You can combine ordinary display characters in repeating patterns to get rough approximations of different weaves.

Plain weave

```
--------------------
--------------------
--------------------
--------------------
--------------------
--------------------
```

Twill weave

```
-=-=-=-=-=-=-=-=-=-=
=-=-=-=-=-=-=-=-=-=-
-=-=-=-=-=-=-=-=-=-=
=-=-=-=-=-=-=-=-=-=-
-=-=-=-=-=-=-=-=-=-=
=-=-=-=-=-=-=-=-=-=-
```

Satin weave

```
=====-=====-=====-====
-=====-=====-=====-===
=-=====-=====-=====-==
==-=====-=====-=====-=
===-=====-=====-=====-
====-=====-=====-=====
```

The best way to explain the program's operation is to look at its menu:

```
1—VIEW THE DESIGN
2—CHANGE A ROW
3—CHANGE A COLUMN
4—COPY ONE ROW TO ANOTHER
5—COPY ONE COLUMN TO ANOTHER
6—FILL THE DESIGN WITH A SINGLE CHARACTER
7—COPY A RECTANGLE
8—END
```

The first option shows you the latest version of the design. When you start, the design will be all dots. The second and third options let you change the contents of the design by row or column. Changing a row is comparable to replacing one horizontal thread with another. Changing a column, however, is comparable to replacing a vertical thread—something you cannot do on a real loom.

The fourth and fifth options save you from repetitious work. After getting a row or column just the way you want it, you can copy it to any other row or column. The sixth option is even better. Suppose you've created a picture—a diamond or a pony, say—inside the space of several rows and columns. You can duplicate the picture by copying the rectangle that contains it to another part of the grid.

The BASIC Program

We'll present the program in blocks of approximately 10 lines and follow each block with comments and explanations. Occasionally we'll give an alternate line or two that you can use in case your computer doesn't

George Stewart is senior technical editor of *Popular Computing*.

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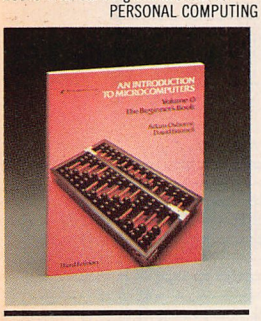

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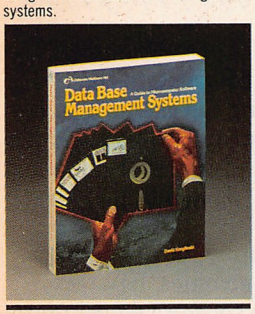

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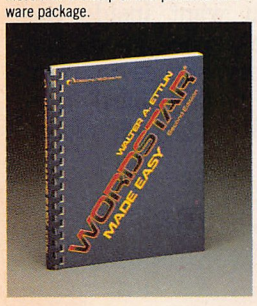

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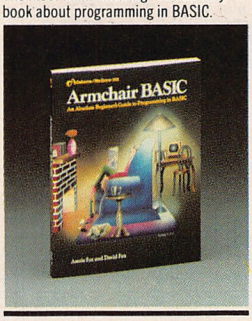

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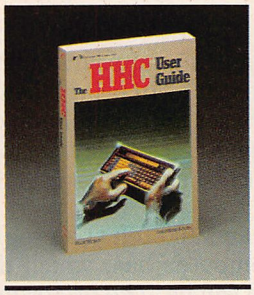

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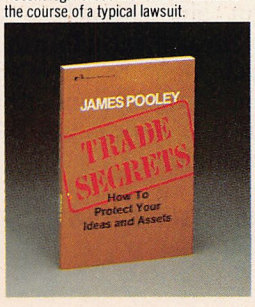

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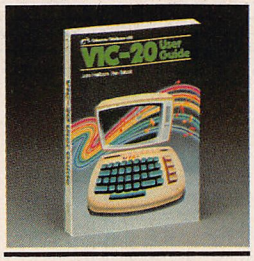

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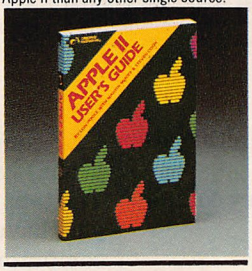

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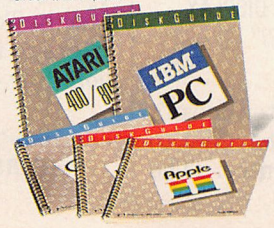

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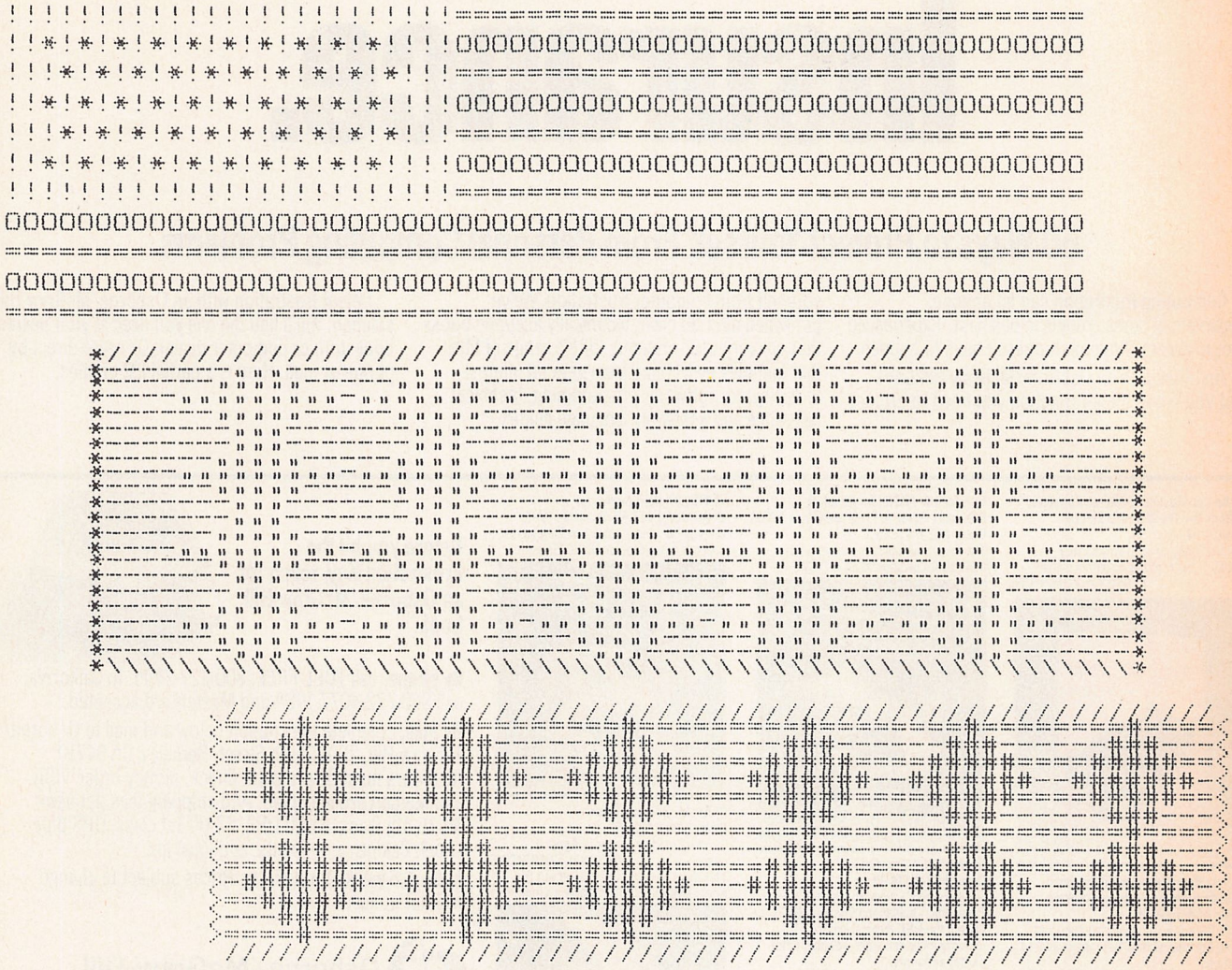

Sample designs created with The Electronic Loom.

have the necessary command. Type in these alternate lines only if you're sure you need them.

The program is long—125 lines—but not very complicated. Here are the first 12 lines:

```
10 CLS: REM—CLEAR THE SCREEN
20 PRINT TAB(20) "THE ELECTRONIC LOOM"
30 PRINT
40 PRINT TAB(17) "PROGRAM FACTORY, JUNE 83"
50 PRINT
60 PRINT TAB(11) "(C) 1983 POPULAR COMPUTING
   MAGAZINE"
70 PRINT
80 CLEAR 5000
90 VS=16: REM—NUMBER OF LINES ON THE DISPLAY
100 VW=64: REM—NUMBER OF COLUMNS ON THE DISPLAY
110 TB$=" HIMOTWXZo!#$%&'( )*:=-,.<>@+;?/"
120 NC=LEN(TB$)
```

Line 10 clears the display. If your computer doesn't recognize the CLS command, delete it or change it to the comparable command for your computer. (The CLS command also appears in line 600 later in the program.) Lines 20 to 70 print a heading for the program. The tabs are set for a 64-column display; adjust them if you have another display format. Line 80 tells the computer to set aside space in memory for 5000 characters.

Lines 90 and 100 tell the program what display format the computer has, which determines how large your design can be. The program is set for a 64-column by 16-row display. If necessary, change the values assigned to VW and VS to fit your computer's display. Line 110 defines the characters you can use to create designs. Put any characters you want inside the quotes. Be sure to include a blank space inside the quotes if you want to have empty spaces in your design. To add graphics and other nonkeyboard characters to the list, you can use BASIC's CHR$( ) function. For example,

```
110 TB$=" HIMOTWXZo!#$%&'( )*:=-,.<>@+;?/"
    +CHR$(34)
```

lets you use a double quote as one of the design characters.

The next program block sets up the initial design according to your specifications for the number of rows and the width of each row:

```
130 REM—GET THE LENGTH AND WIDTH OF THE DESIGN
140 REM—AND INITIALIZE THE ARRAY D$( )
150 INPUT "HOW MANY ROWS"; RX
160 IF RX<VS THEN 190
170 PRINT "NO. OF ROWS CANNOT EXCEED"; VS-1
180 GOTO 150
190 INPUT "HOW WIDE IS EACH ROW"; WX
200 IF WX<VW THEN 230
210 PRINT "WIDTH CANNOT EXCEED"; VW-1
220 GOTO 190
230 DIM D$(RX)
240 C$="."
250 GOSUB 540: REM—FILL ARRAY WITH C$
```

Lines 170 and 210 ensure that the size you specify is small enough to fit on your screen. Line 230 sets up a one-dimensional string array to contain the design. Each element of the array corresponds to one row of the design. Line 240 specifies the character to be used initially in filling the design, and line 250 uses the fill subroutine described later.

At this point, the basic structure for the design is set up. The following program block contains the menu:

```
260 PRINT "TYPE IN THE NUMBER OF YOUR CHOICE": PRINT
270 PRINT "1—VIEW THE DESIGN"
280 PRINT "2—CHANGE A ROW"
290 PRINT "3—CHANGE A COLUMN"
300 PRINT "4—COPY ONE ROW TO ANOTHER"
310 PRINT "5—COPY ONE COLUMN TO ANOTHER"
320 PRINT "6—FILL THE DESIGN WITH A SINGLE CHARACTER"
330 PRINT "7—COPY A RECTANGLE"
340 PRINT "8—PRINT THE DESIGN"
350 PRINT "9—END"
360 INPUT Q
370 ON Q GOSUB 600, 670, 790, 980, 1050, 390, 1140,
    930, 430
380 GOTO 260
```

Whenever the program completes the function you select, it returns to this menu. Each function is set up as a subroutine. The menu includes eight functions plus END. Later we'll discuss ways of adding your own customized functions to the program.

The rest of the program listing consists of the subroutines. Here's the first group:

```
390 PRINT "SELECT THE FILL CHARACTER"
400 GOSUB 450: REM—DISPLAY CHARACTER SET AND GET A
    SELECTION
410 GOSUB 540: REM—FILL THE ARRAY WITH IT
420 RETURN
430 END
440 REM—DISPLAY CHARACTER SET AND GET A SELECTION
```


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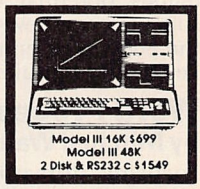
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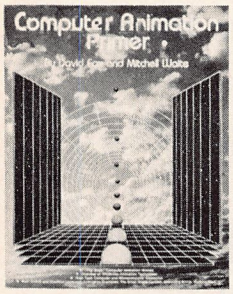

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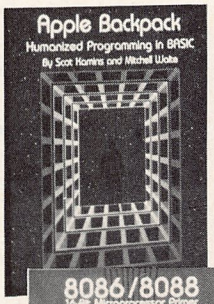

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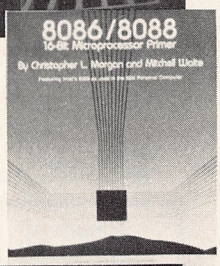

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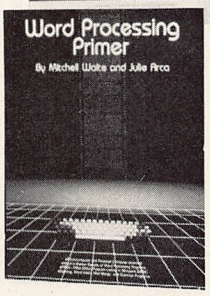

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```
450 FOR I=1 TO NC
460 PRINT I;MID$(TB$,I,1),
470 NEXT I
480 PRINT
490 INPUT "ENTER THE NUMBER OF THE CHARACTER YOU
    WANT"; I
500 IF I<1 OR I>NC THEN 490
510 C$=MID$(TB$,I,1)
520 RETURN
530 REM—FILL THE ARRAY WITH C$
540 F$=STRING$(WX,C$)
550 FOR I=1 TO RX
560 D$(I)=F$
570 NEXT I
580 RETURN
```

Lines 390 to 420 correspond to option 6, selecting a fill character. This subroutine "calls" a couple of others. Line 430 ends the program (option 9). Lines 440 to 520 show what characters are available and ask which character you want. The STRING$ function in line 540 builds a repeating string of character C$, length WX. The resulting string is stored in F$. If your computer doesn't have STRING$, you can simulate it with this alternate line 540:

```
540 F$=" ": FOR I=1 TO WX:F$=F$+C$: NEXT I
```

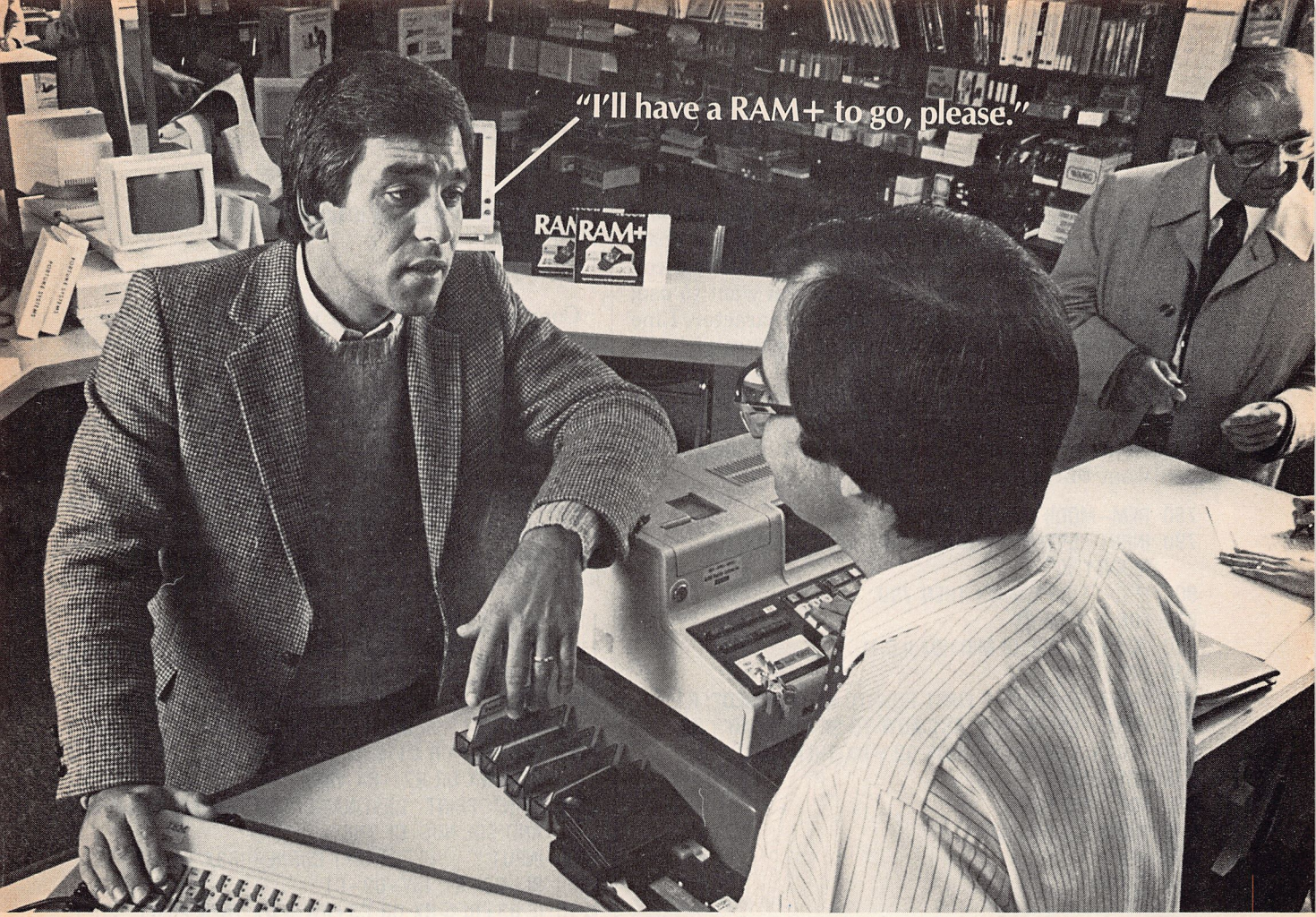
Here's the subroutine that shows you the design:

```
590 REM—VIEW THE DESIGN
600 CLS: REM—CLEAR THE SCREEN
610 FOR I=1 TO RX
620 PRINT D$(I)
630 NEXT I
640 INPUT "PRESS <ENTER> TO CONTINUE"; Q$
650 RETURN
```

Here's the subroutine to modify a row:

```
660 REM—MODIFY A ROW
670 INPUT "ENTER THE NUMBER OF THE ROW TO MODIFY"; R
680 IF R<1 OR R>RX THEN 670
690 PRINT TAB(9)"1"TAB(19)"2"TAB(29)"3"TAB(39)"4"
    TAB(49)"5"TAB(59)"6"
700 PRINT"12345678901234567890123456789012345678901234567890"
710 PRINT D$(R)
720 INPUT "ENTER THE FIRST COLUMN TO BE CHANGED"; C1
730 INPUT "ENTER THE LAST COLUMN TO BE CHANGED"; C2
740 IF C1<1 OR C1>C2 OR C2>WX THEN 710
750 GOSUB 450
760 MID$(D$(R),C1,C2)=STRING$(C2-C1+1,C$)
770 RETURN
```

Lines 690 and 700 print a heading above the row that you select. The heading consists of column numbers to help you specify which portion of the row you want to change. The heading assumes your display has 64 columns. You may need to shorten or extend the heading to suit the number of columns on your display.



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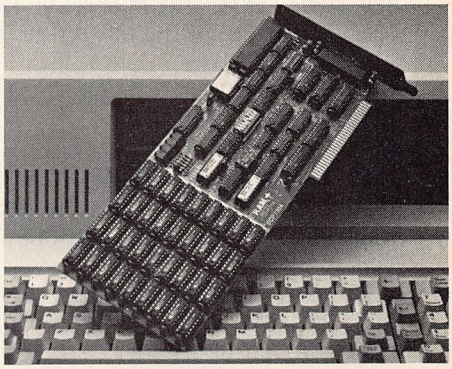

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Circle 97 on inquiry card.

The subroutine to modify a row asks for the first and last column to be changed. To change only one character, type the same number for the first and last column. Next, select the new character you want to use; line 750 calls the subroutine to select a character. Line 760 replaces the specified portion of the row with the new contents.

The subroutine to modify a column is similar. The row numbers are displayed alongside the selected column to help you identify which section of the column you want to change.

```
780 REM–MODIFY A COLUMN
790 INPUT "ENTER THE NUMBER OF THE COLUMN TO
    MODIFY";C
800 IF C<1 OR C>WX THEN 790
810 FOR I=1 TO RX
820 PRINT I; TAB(10) MID$(D$(I),C,1)
830 NEXT I
840 INPUT "ENTER THE FIRST ROW TO BE CHANGED"; R1
850 INPUT "ENTER THE LAST ROW TO BE CHANGED"; R2
860 IF R1<1 OR R1>R2 OR R2>RX THEN 840
870 GOSUB 450
880 FOR I=R1 TO R2
890 MID$(D$(I),C,1)=C$
900 NEXT I
910 RETURN
```

The subroutine that prints the design is almost identical to the one that shows the design (lines 590 to 650):

```
920 REM–PRINT THE DESIGN
930 FOR I=1 TO RX
940 LPRINT D$(I)
950 NEXT I
960 RETURN
```

LPRINT sends the design to the printer. If this command doesn't work on your computer, check your BASIC reference manual for the command or procedure that does the same thing.

Here are the lines to copy a row or column:

```
970 REM–COPY ONE ROW TO ANOTHER
980 GOSUB 610: REM–VIEW THE DESIGN
990 INPUT "ENTER THE NUMBER OF THE SOURCE ROW"; R1
1000 INPUT "ENTER THE NUMBER OF THE DESTINATION
     ROW"; R2
1010 IF R1<1 OR R1>RX OR R2<1 OR R2>RX THEN 990
1020 D$(R2)=D$(R1)
1030 RETURN
1040 REM–COPY ONE COLUMN TO ANOTHER
1050 GOSUB 610 : REM–VIEW THE DESIGN
1060 INPUT "ENTER THE NUMBER OF THE SOURCE COLUMN";
     C1
1070 INPUT "ENTER THE NUMBER OF THE DESTINATION
     COLUMN"; C2
1080 IF C1<1 OR C1>WX OR C2<1 OR C2>WX THEN
     1060
1090 FOR I=1 TO RX
1100 MID$(D$(I),C2,1)=MID$(D$(I),C1,1)
1110 NEXT I
1120 RETURN
```

Copying a row is quite easy; one array element is simply replaced with another (line 1020). Copying a column is more complicated because every array element in the column must be modified. For example, if you want to copy column 7 to column 10, the seventh character in D$(1) must be copied to the position of the tenth character in D$(1), and this process must be repeated for each array element (lines 1090 to 1110).

The final subroutine is the most versatile. Once you complete a pattern or picture covering a part of the loom area, you can copy the pattern anywhere else.

```
1130 REM–COPY A RECTANGLE
1140 PRINT "SOURCE RECTANGLE: ENTER ROW AND COL NOS.
     OF THE..."
1150 INPUT "    UPPER LEFT CORNER (R1,C1)"; R1,C1
1160 INPUT "    LOWER LEFT CORNER (R2,C2)"; R2,C2
1170 IF R1<1 OR C1< 1 OR R2<R1 OR C2<C1 OR
     C2>WX OR R2>RX THEN 1140
1180 PRINT: PRINT "DESTINATION RECTANGLE: ENTER ROW
     AND COL NOS. OF THE..."
1190 INPUT "    UPPER LEFT CORNER (R3,C3)"; R3,C3
1200 RL=R2-R1: RW=C2-C1
1210 IF R3+RL>RX OR C3+RW>WX THEN PRINT "COPY
     WOULD EXCEED LOOM BOUNDARIES": GOTO 1140
1220 FOR I=0 TO RL
1230 MID$(D$(R3+I),C3,RW+1)=MID$(D$(R1+I),C1,RW+1)
1240 NEXT I
1250 RETURN
```

The source rectangle contains the pattern to be copied. You define the rectangle by specifying the coordinates of its upper left-hand corner and lower right-hand corner. The destination rectangle is the area that will receive the copy. You define it by specifying the coordinates of the upper left-hand corner only. These two rectangles can overlap, but the results may not always be what you intended.

The figure on page 234 shows some designs we created and then printed with a dot-matrix printer. If your printer has variable line spacing, try different values. Six lines per inch is normal, but 8 or even 12 lines per inch often produces more interesting designs. You might also try condensed and bold characters if they are available on your printer. (Before starting the program, output the necessary control codes to your printer to get it into the desired mode.)

If you have questions about this article or suggestions for future projects, send them to: The Program Factory, POB 397, Hancock, NH 03449. Listings of past programs for the Apple, TI-99/4A, ZX81, VIC-20, and TRS-80 Color Computer are also available; specify your computer model and enclose a stamped, self-addressed envelope with sufficient postage for a 2-ounce first-class letter. □

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COMING UP

Special Report on Printers

Next month's special report on more than 25 printers that sell for less than $1000 will feature capsule reviews outlining each machine's strengths and weaknesses. In addition, you'll get some hard-headed advice on how to match the printer to the application and how to select a printer buffer.

Micros Help Fight Bureaucracies

The so-called little guys are using personal computers to fight back against big bureaucracies. If you've ever daydreamed about using your microcomputer to block a $5-billion power plant or stop Uncle Sam from cutting down forests in your county, you'll be heartened by this saga of brave computerists who are doing just that—and more.

Educational Games

The Search Series consists of five simulation games that teach school kids how to take an active, rather than passive, role in problem solving. Whether the kids are navigating the high seas or searching for oil, the game teaches them how to accept the consequences of certain actions. In short, the students are learning how to *think*.

Was Superscripsit Worth the Wait?

You'll find plenty of TRS-80 users who swear that the Scripsit word processor is just like Washington Redskins' running back John Riggins: not flashy but very effective. Now Radio Shack has readied an enhanced version of that product called Superscripsit. We'll take a close look at this successor to a very reliable piece of software. Superscripsit gives you more print options, but was it worth the wait?

Is This a Joke, Doc?

Eliza is an interactive computer program that appears to respond to your innermost questions just as a psychotherapist would. But Eliza's inventor, Joseph Weizenbaum, of the Massachusetts Institute of Technology, protests that the program is really just an elaborate in-joke. Nonetheless, the BASIC version of Eliza has sold well, raising fears that some folks out there are using it as an ersatz shrink. Have we taken Eliza a little too far?

Plus our regular columns including:

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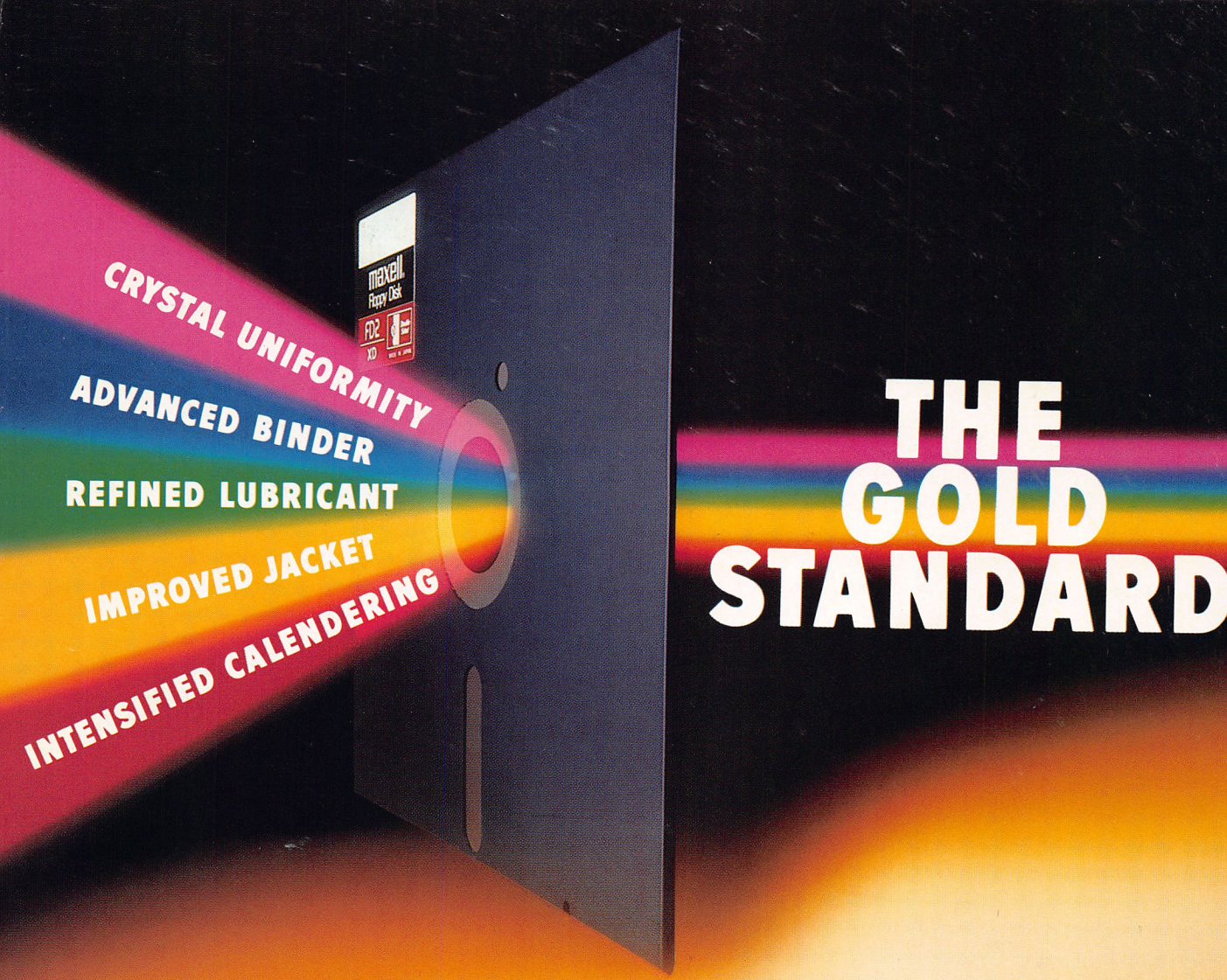

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